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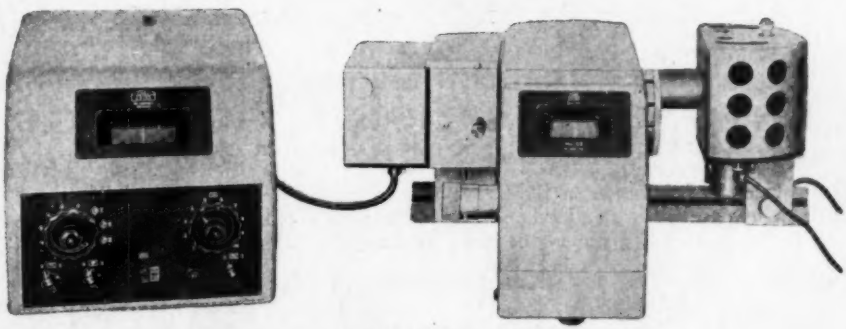

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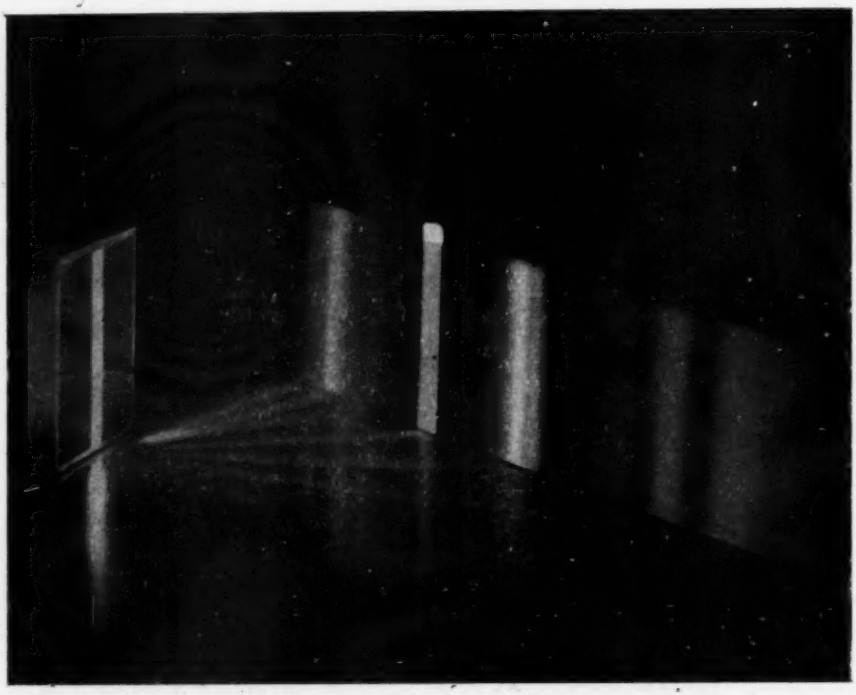

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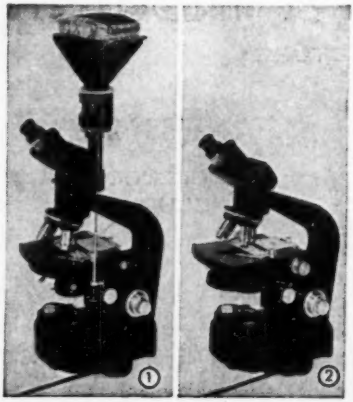

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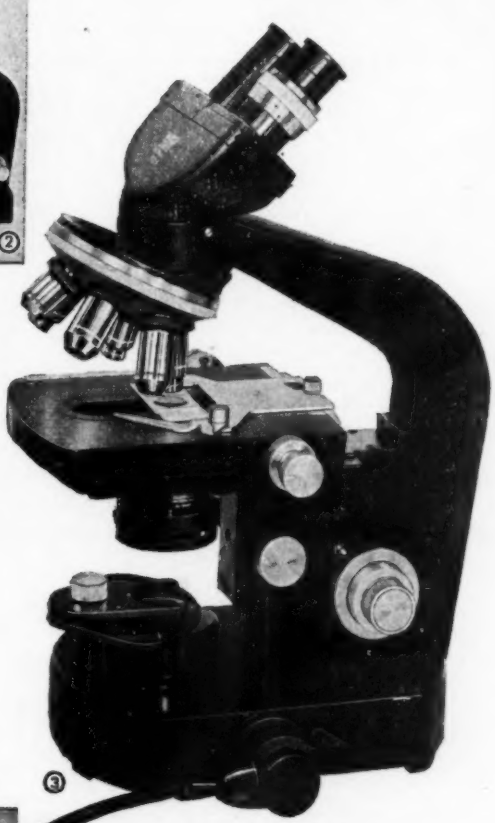

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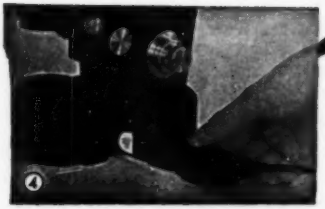

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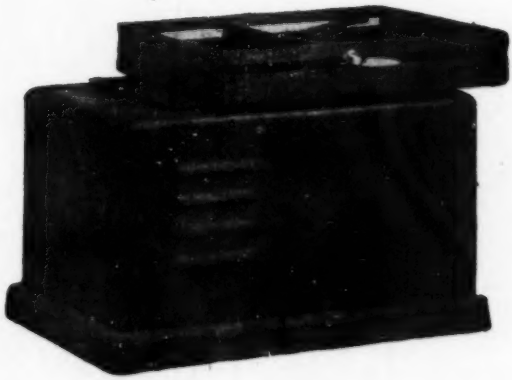

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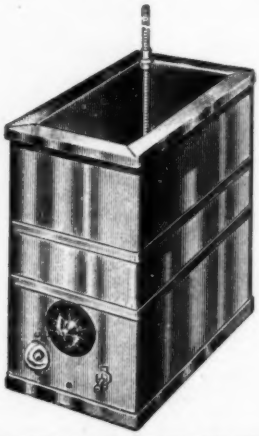

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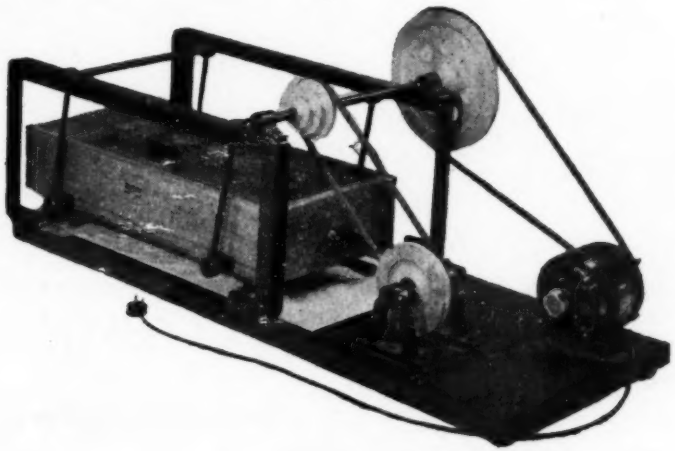

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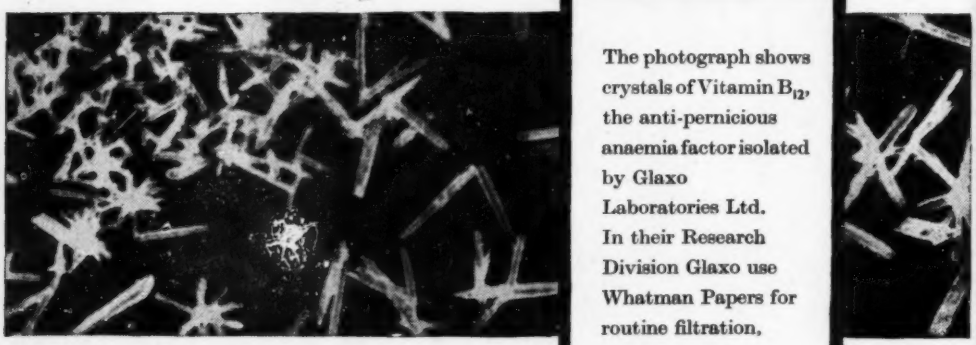

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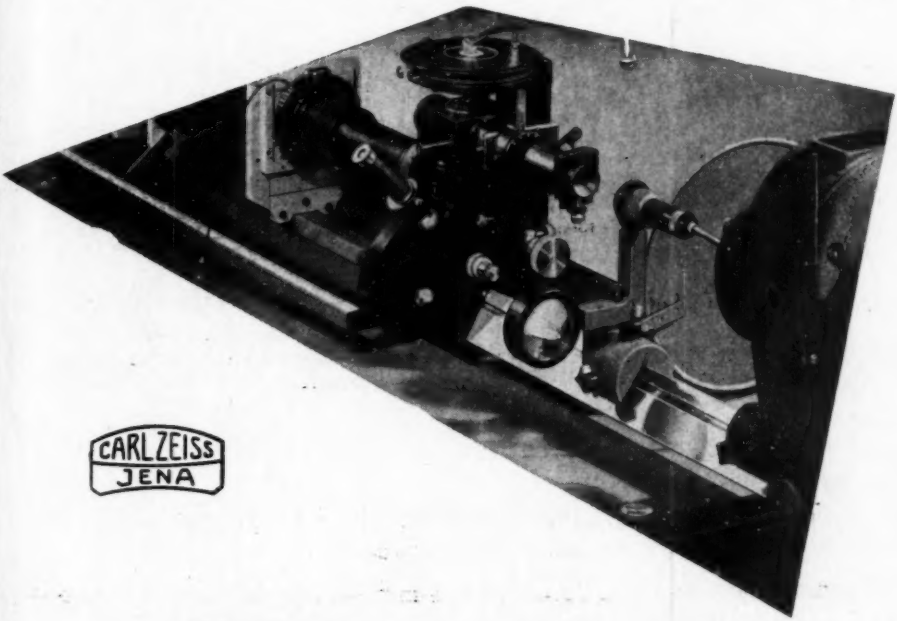

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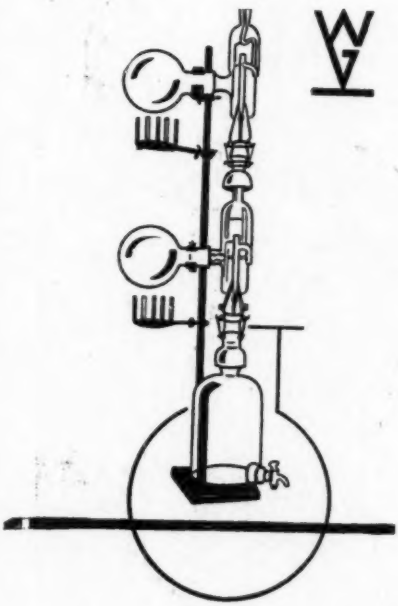

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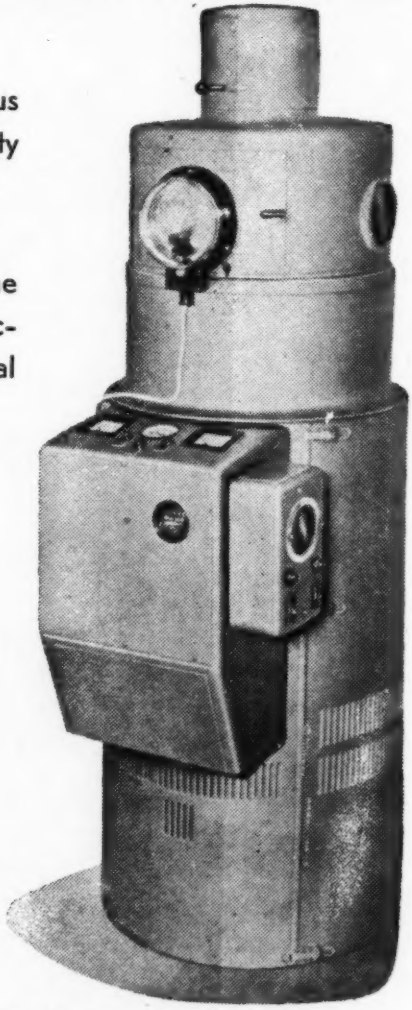

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NIGHTGLOW AND TWILIGHT IN THE ANTARCTIC*

Introduction

DR. ANTONIN MRKOS, the author of this article, is a member of the scientific group for the high atmosphere studies at the Chechoslovak Academy of Sciences and participated in the third Soviet Antarctic Expedition (1957-58) organized within the IGY research activities. Dr. Mrkos carried out his observation of the night sky at the Antarctic Observatory Mirny and also aboard the vessels Kooperatzia and Ob sailing across the Indian and Atlantic oceans in the regions between the two polar circles. The scientific programme planned out for his study dealt chiefly with researches of the high atmosphere by indirect methods. These comprised: (1) photoelectric measurements of the nightglow, (2) photoelectric measurements of the twilight and dawn, (3) observing, measuring and photographing of auroras, (4) photographing of auroral spectra, (5) observing of telescopic meteors, (6) observing of noctilucent clouds and noctilucent bands.

FIG. 1. The Mirny Observatory. In the background are the airfield and broadcasting station.

Instruments and Method

The measurements of the nightglow were made with a photoelectric photometer in four spectral ranges determined by the four Schott-Jena interference filters giving maximum transmission near wavelengths 5300 Å, 5577 Å, 5894 Å and 6300 Å respectively. The range of transmission about these maxima was 60-100 Å. The measurements were carried out exclusively in zenith. The instruments were installed in a small wooden house situated northerly from the Mirny Observatory on the cape Chmara on the coast of the Davis Sea (Fig. 1). The position of the instrumentation was 66° 33′ S. and 93° 01′ E. The house was electrically heated which permitted the equipment to be kept at a relatively constant temperature and also enabled work to be continued even during severe frosts and winds. The time accuracy of the observation was ensured by a chronometer as well as by a radio receiver which received the time signals from Washington, Tokyo and Honolulu. Anode batteries were used as source for the photoelectric multiplier FEU-17. The deflections were read on the Interflex mirror galvanometer. Measurements were made every hour both on bright nights and on moonless nights. The intensities of individual emissions transmitted by the interference filters were measured by substitution with an electric light source connected to the Wheatstone bridge. The conditions of measurements as well as the weather were more favourable in Mirny than in Central Europe. Between February 24 and October 12, 1958, a total of 134 night measurements were effected. Further, 30 night measurements were carried out aboard the ships.

FIG. 2. *Aurora borealis* over Mirny (its most frequent form).

From the end of April 1958, a systematic recording of the green emission of the nightglow at 5577 Å was made at intervals between the measurements. The recording was done by means of an electronic potentiometer EPP-09, with a sensitivity of 1 mV for the total range and record speed of 120 mm./hour, connected to the output of an electronic photometer. To further elucidate the information on the auroras, this recording was conducted also on nights with overcast sky and on clear moon nights. Experience showed that in Antarctica on moonless

* Through the courtesy of the Consulate-General of the Czechoslovak Republic, Bombay, India.

nights a full cloudiness—type cirrostratus, altostratus and altocumulus—does not prevent the recording of very weak auroras which otherwise would pass unobserved because of the cloudiness.

Summary of Results on Nightglow Intensities

1. The observed intensities of the nightglow varied abruptly from night to night, the variations being sometimes as great as 100%. The two oxygen emission lines 5577 Å and 6300 Å showed, at their abrupt fluctuations in brightness, a systematic decrease of intensity which was observable up to the end of June. This was followed by a moderate increase in brightness and subsequently a systematic decrease recorded up to the middle of October when the measurements were closed. The systematic decrease in intensity of the green emission during the Antarctic night 1958 corresponded relatively well with the decrease of the absolute ozone contents in the atmosphere during the same period. These abrupt fluctuations in intensity of both the emissions are likely to be caused by the activity of weak, visually unobservable auroras.

2. During a night, often several maxima and minima were recorded at individual emissions. A very striking minimum of the green emission 5577 Å took place close to the dawn. The evening decrease in intensity of the green emission 5577 Å was by far more abrupt than that in the red emission 6300 Å which, on the other hand, began to increase in the morning 1-2 hours before the onset of the astronomical dawn.

3. A violent decrease, often below the night average, of both emissional regions 5577 Å and 6300 Å occurred also immediately after the passing of bright auroral forms through the measured point of the sky, when the aurora lower down on the sky was still very active. This decrease was more pronounced in the region 5577 Å than in the region 6300 Å. Such local decrease in intensity of the nightglow emission has not been observed in middle latitudes.

4. In the integral nightglow a considerable increase in intensity with the geographical latitude was recorded in 1957. The average intensity of the nightglow in Mirny towards the end of February 1958 was three times as great as that in the tropical region at the position 20° 34′ S and 57° 13′ E. When these measurements were repeated in 1959, during the trip aboard the ship Ob between 70° S and 54° N, such a striking decrease of the nightglow towards the Equator was not recorded. In 1959 the nights in the equatorial region were far brighter than those towards the end of 1957 and at the beginning of 1958 when, for example, the *Gegenschein* could be observed every night. In spite of the same astronomic observations conditions this phenomenon was never recorded in 1959.

5. The relative increase of the red emission at 6300 Å before the start of, during and after the auroral displays, was far feebler in the latitude of Mirny than in middle latitudes. The time intervals between the onset of the increase of the emission before the aurora and the decrease after the aurora were far shorter.

Telescopic Meteors

A systematic study of the telescopic meteors, up to the limit magnitude of 9 *m*, on every clear moonless night proved that during the Antarctic night 1958, the hour frequency of the meteors in a given instrumentation was twice as low in Antarctica as in Central Europe.

The influence of this frequency on the emission intensity of sodium 5894 Å was studied and it was noted that on nights with increased intensity of telescopic meteors the absolute emission intensity of 5894 Å also increased. A similar increase of sodium emission was also observed during the nights when noctilucent bands occurred on the sky.

The results of the systematic recording of the variations in intensity of the green emission 5577 Å during the auroral displays (Fig. 2) were compared with the records of the variations of all components of the geomagnetic field, telluric streams and ionosphere vertical soundings. It appeared that (1) in the period of intensive outbursts of the green emission at 5577 Å, the vertical ionograms showed a diffuse reflection occurring at the heights of 150–180 km. It is the sporadic E layer of *a* or *q* type. (2) The large variations of all components of the telluric stream corresponded exactly both in time and in relative changes with the fluctuations in intensity of the recorded green emission 5577 Å. (3) The same correlation has been noted in the records of the variations of the geomagnetic field in almost all components. The above correlations were maximum in case of the auroras passing through the magnetic zenith and far feebler when the auroral displays were located at a distance of more than 20° from the magnetic zenith.

Twilights

131 twilights were measured in Mirny. The measurements of the twilight started usually on the solar depression of 5° and terminated

on the depression of 18°. The analysis of these measurements has not been made as yet.

During the measurements of the twilight, a phenomenon of particular interest was recorded. Nearly every day, before the end of the astronomical twilight, from the solar depression of 14° up, weak-rayed auroral display took place on almost the same spot of the sky showing South-North direction in the evening and East-West direction in the morning. In the evening the brightest rays usually passed through the point located at a distance of about 8° WNW from the zenith. The brightness of these auroral displays was mostly very faint and, without photometric measurements, unobservable. These auroras persisted usually for more than 1-2 hours at the end of the astronomical twilight. From the middle of March to the end of June the start of these auroras progressed by 5 hours in the evening whereas in the morning it delayed by 4 hours. No effect of these auroral displays on the recording of the geomagnetic field and telluric streams has been recorded. From the temporal variation in the start of these auroras in the course of the year as well as from their form and colour it may be concluded that these are special types of auroras appearing mostly during the daytime and caused by other processes of solar activity than those which cause the nocturnal auroras which have a steady maximum in Mirny at about 18 hours UT.

Noctilucent Clouds and Bands

The noctilucent clouds were observed twice during the period of study in Mirny. For the first time they appeared on 28th March 1958 at 13 hr. 35 min. UT, showing considerable motion in ESE direction. Their estimated height was 82 km., and the real velocity of these clouds was 350 km./hour. The same day, a stratospheric jet-stream in the same direction and of the same velocity was measured by the aerometeorological group of Prof. Bugajev in Mirny. For the second time, the noctilucent clouds were observed on 13th May 1958 at 11 hr. 30 min. UT in zenith, being this time nearly stationary, with only a slow motion to SSW. In other respects, these noctilucent clouds did neither in colour nor in form differ from those observed in Central Europe.

On several nights, the noctilucent bands were observed in Mirny during 1958. They were usually brighter than those in Central Europe and were radially disposed on the sky with the radiation points from N to ES. The region of their maximum frequency in Mirny was that of SE. The noctilucent bands were observed also during the author's trips aboard Kooperatzia and Ob. Their first appearance in the southern hemisphere was recorded at 37° S. They were never observed in the tropical region.

Conclusion

The measurements of the instrumentation, filters and photomultipliers were conducted in the Astronomical Institute of the Czechoslovak Academy of Sciences and the measured intensities of the nightglow have been converted into absolute rayleigh units. By the end of this year, the values of the green emission 5577 Å are to be analysed and forwarded to the corresponding World Centres. Thanks to the support of the geophysic group III, SAE, the author's instrumentation was amplified by the spectrograph SP-47 1 : 1 with a dispersion of 200 Å/mm. and by the recording electronic potentiometer EPP-09. The chief of this group also permitted the use of the records of the vertical ionosphere soundings, telluric streams and variations of the geomagnetic field.

DEFENCE ELECTRONICS CONVENTION

A DEFENCE Electronics Convention, first of its kind in the country, was held in Bangalore from September 28 to October 1, 1959. Over 350 delegates representing 42 different major organisations got together for an intensive three-day discussion and interchange of views on the applications of electronics to Defence needs. Coinciding with the Convention, an electronics exhibition was also organised.

Inaugurating the Convention, Major-General B. D. Kapur stressed upon the growing application of electronics to the Defence equipment and the need to evolve our own standards for evaluation of equipments suited to Indian conditions.

Over 40 significant papers were read and discussed during the technical sessions, ranging from problems in Development and Production of Electronic Equipment, Effects of Environmental Hazards on Electronic Equipment, Guidance and Control Systems, Automation, Instrumentation, Reliability Problems, and Education and Training of Electronic Engineers.

Highlights of the whole programme were two talks one by Sir C. V. Raman on 'Infra-Red Radiation' and the other by Major-General B. D. Kapur on 'Career Prospects for Scientific and Technical Personnel in the Ministry of Defence'. Prof. M. S. Thacker delivered the Distinguished Guest Speaker's Address.

[Current Science

BIOGENESIS OF NATURALLY OCCURRING TETRONIC ACID DERIVATIVES

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Department of Chemistry, University of Delhi, Delhi-8

DERIVATIVES of tetronic acid (I) have been recognised as metabolic products of moulds belonging to the groups of *Penicillia* and *Aspergilli*. A number of them have been isolated by Raistrick[1] and his collaborators and their structures established and a few of them confirmed by synthesis. They are tabulated in Table I.

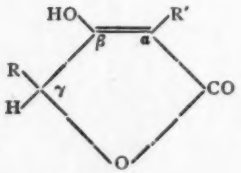
TABLE I

Compound	Sources
γ-Methyltetronic acid[2] (II) ..	*Penicillium charlesii*
Carolic acid[3,4] (III) ..	do.
Carolinic acid[3,4] (IV) ..	do.
Carlosic acid[3] (V) ..	do.
Carlic acid[3,5] (VI) ..	do.
Terrestric acid[6] (VII) ..	*P. terrestre*
Dehydrocarolic acid[7] (VIII) ..	*P. cinerascens*
Penicillic acid[8-10] (IX) ..	*P. puberulum, P. cyclopium, P. thomii, P. suaveolens, Aspergillus ochraceus*
L-(+) Ascorbic acid[11] (X) ..	*A. niger*

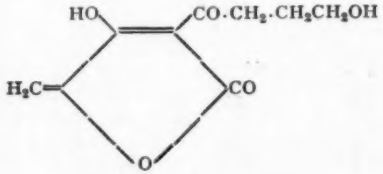
For the sake of convenience, compounds III, VI, VII, and VIII are here represented in the hydrated form with only one ring, though they are known to occur only in the anhydrous form having a second ring involving the acidic hydroxyl group in the β-position and the present in the side chain, *e.g.*, VIII *a* for compound VIII. Of these, the first seven compounds (II to VIII) form a closely related group and the other two appear to have different origin.

ASCORBIC ACID

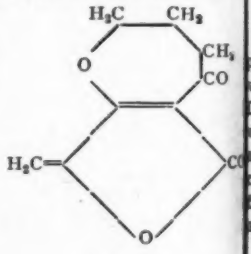
L-(+) Ascorbic acid (X) (vitamin C) has been known to be widely occurring as a product of higher plants also. Its structure (X) is closely related to hexoses and hence it may have a direct biogenetic relation to carbohydrates. Suggestion was made by Rangaswami and Seshadri[12] that the biogenesis of L-ascorbic acid (X) from D-glucose (XI) may involve the following changes. D-glucose (XI) was considered to undergo easy conversion into D-fructose (XII) which, by epimerization at C_5, may lead to L-sorbose (XIII) ; the subsequent



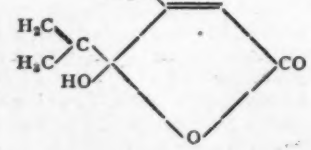
I, R=R'=H
II, R=CH$_3$; R'=H
III, R=CH$_3$; R'=CO·CH$_2$·CH$_2$·CH$_2$OH
IV, R=CH$_3$; R'=CO·CH$_2$·CH$_2$COOH
V, R=CH$_2$·COOH; R'=CO·CH$_2$·CH$_2$·CH$_3$
VI, R=CH$_2$·COOH; R'=CO·CH$_2$·CH$_2$·CH$_2$OH
VII, R=CH$_3$; R'=CO·CH$_2$·CH$_2$·CHOH·C$_2$H$_5$



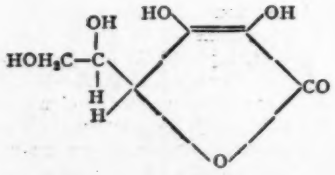
VIII



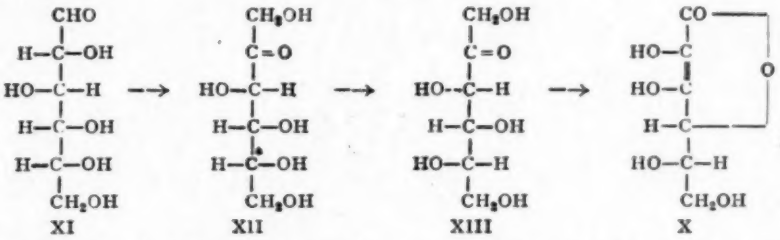
VIII *a*



IX



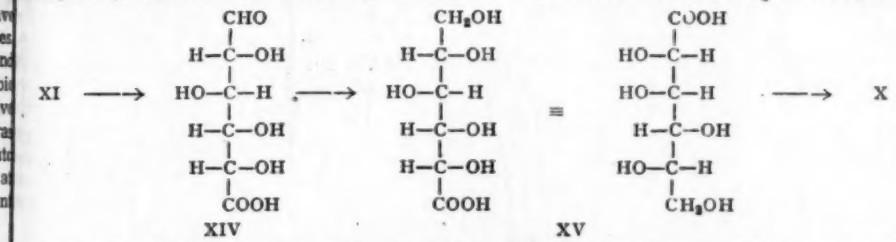
X



XI XII XIII X

teps were analogous to those well known in aboratory synthesis.

Horowitz *et al.*[13] found that the radioactivity (C^{14}) of the aldehyde carbon atom of D-glucose (XI) was noted in the sixth carbon atom of L-ascorbic acid (X). Based on this, Isherwood *et al.*[14] suggested that D-glucose (XI) undergoes oxidation to D-glucuronic acid (XIV) which, by reduction, forms L-gulonic acid (XV), subsequently oxidised to L-ascorbic acid (X).



XIV XV

However, recently Loewus and Jang[15,16] proved that the observation of Horowitz *et al.*[13] was wrong and found that the pathway of D-glucose (XI) to L-ascorbic acid (X) proceeded without cleavage and that the aldehydic carbon atom (C^{14}) of D-glucose formed the carboxyl carbon of L-ascorbic acid. In the light of these findings, the original suggestion of Rangaswami and Seshadri[12] may appear to be more valid.

Penicillic Acid

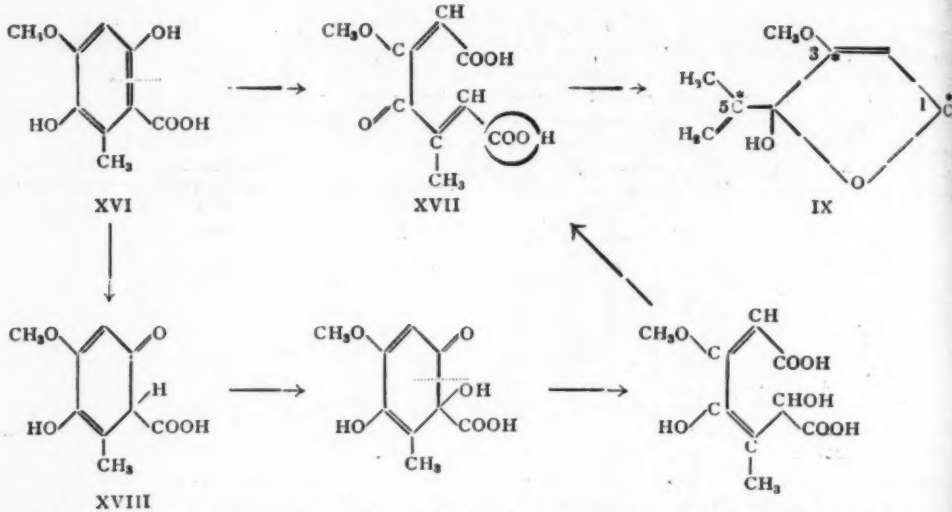
Birch and his co-workers[17] studied the biosynthesis of penicillic acid (IX). They first considered that it had a terpene origin but tracer studies with mevalonic acid lactone did not support this. However, labelled acetic acid ($CH_3.C^{14}OOH$) was incorporated in the biosynthetic penicillic acid and the activity was noted in carbon atoms 1, 3 and 5. In order to explain this, they suggested 5-hydroxyeverninic acid (XVI) as the precursor of penicillic acid (IX). Compound (XVI) was considered to undergo oxidative ring fission to (XVII) which on subsequent ring closure as well as decarboxylation would give penicillic acid (IX). This scheme is chemically acceptable. As a probable mechanism for this type of ring fission, it is now suggested that it involves α-hydroxylation of the ketonic form (XVIII) of 5-hydroxyeverninic acid (XVI) followed by hydrolysis. It is known that reagents like Fenton's, which are analogous to enzyme systems, can bring about such α-hydroxylations.[18] Ring fission of aromatic compounds in the evolution of natural products seems to be fairly common (*e.g.*, patulin[19]).

The above-mentioned C_8-unit origin of penicillic acid receives support from the fact that the concerned moulds, *Penicillium puberulum* and *P. cyclopium* are also known to produce compounds like puberulic and puberulonic acids[20] (tropolone derivatives) as well as cyclopolic and cyclopaldic acids[21] (benzenoid derivatives) respectively which are all derived from C_8-units.[22,23]

γ-Methyltetronic Acid Group

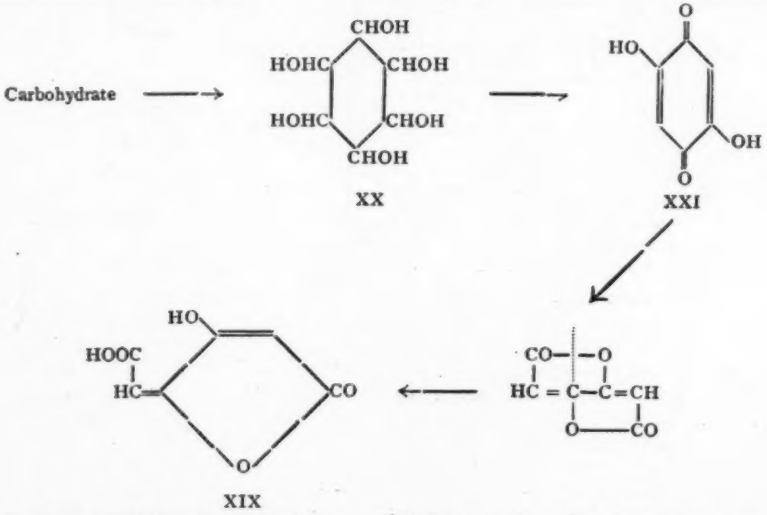
As mentioned earlier, the first seven members (*see* Table I) form a related group. Among them, the simplest would be γ-methyltetronic acid (II) and the others would arise by a further stage of substitution in the reactive α-position. The occurrence of dehydrocarolic acid (VIII) which has a methylene group in the γ-position would suggest that the common intermediate could be the carboxymethylene derivative (XIX) from which all other members may arise by feasible transformations.

The C_8-unit (orsellinic unit) appears to be unsuitable as a precursor for these tetronic acids. Similarly it is difficult to derive them directly from carbohydrates. In this connection should be mentioned the recent work of Lybing and Reio[24] on the biosynthesis of carolic acid (III)



and carlosic acid (V). Their results indicate (i) that the acetate theory is not fully applicable to these acids and (ii) that the molecules consist of two portions, a 6-carbon chain of β-ketonic acid type and a 4-carbon chain which probably arises from carbohydrates.

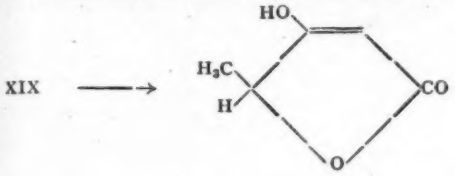
may be considered as the appropriate starting point for the evolution of many of the tetronic acids. This compound (XXI) can undergo oxidative ring opening similar to what has been suggested by Mittal and Seshadri[26] for the formation of pulvinic acid derivatives from



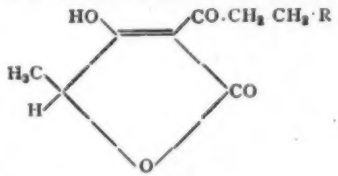
Based on the above considerations, the following suggestion that they have their origin in hydroxybenzoquinones is now made. In an earlier paper in this series,[25] it has been pointed out that inositol (XX) is most probably the precursor for the simpler hydroxybenzoquinone derivatives. 2 : 5-Dihydroxybenzoquinone (XXI)

polyporic acid series. Laboratory analogies for this type of ring fission are known. For example, polyporic acid is oxidised to pulvinic lactone by lead tetra-acetate.[27] As mentioned earlier, γ-carboxymethylenetetronic acid (XIX), which can arise from the above ring fission, may be the common intermediate.

γ-Methyltetronic acid (II) can be formed from (XIX) by stages involving decarboxylation and reduction of the exocyclic double bond. Carolic acid (III), carolinic acid (IV) and terrestric acid (VII) have side-chains in the α-position of the above γ-methyltetronic acid (II) unit. It is easy to conceive that they arise by substitution in the reactive α-position.

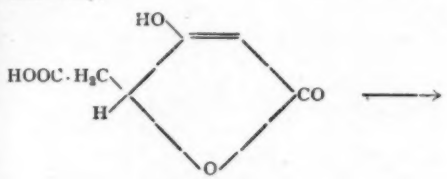


II

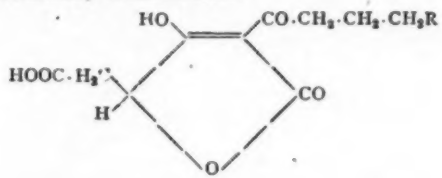


III, R = CH_2OH
IV, R = COOH
VII, R = $CHOH \cdot C_2H_5$

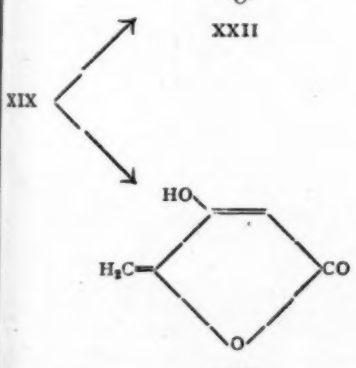
In the case of compounds (III) and (IV), a 4-carbon unit (*e.g.*, tetrose) is involved and in (VII), it is a 6-carbon unit (*e.g.*, hexose). Subsequent oxidation reduction in the side-chain would lead to the required modifications (III, IV and VII).



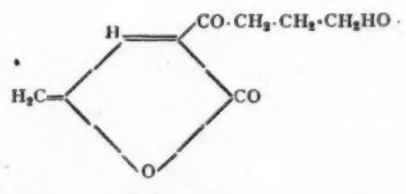
XXII



V, R = H
VI. R = OH



XXIII



VIII

A similar course could be suggested for the evolution of carlosic acid (V) and carlic acid (VI). For these, the appropriate earlier stage would be the intermediate γ-carboxymethyltetronic acid (XXII) which can arise from γ-carboxymethylenetetronic acid (XIX) by reduction without decarboxylation. Subsequent α-substitution by a 4-carbon unit would give carlosic acid (V) and carlic acid (VI). Dehydrocarolic acid (VIII) would require a slightly different intermediate (XXIII) which is the product of decarboxylation of (XIX) without reduction. This is followed by α-substitution by a 4-carbon chain.

SUMMARY

Tetronic acids so far known as mould products seem to fall into three categories: (1) Ascorbic acid type arising directly from sugars; (2) penicillic acid type arising from C_n-(orsellinic) unit and (3) γ-methyltetronic acid type derived from dihydroxybenzoquinone and eventually from inositol.

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NEW LIGHT ON THE PINEAL GLAND

THE Pineal gland, the seventeenth-century philosophers' 'seat of the soul', long believed to have no biological function, is now thought to have important secretory functions. Recent investigations show that there are four neurohumoral substances in bovine pineal gland; serotonin. (5 H, 5 hydroxytryptamine), norepinephrine, histamine and acetylcholine. A fifth pineal hormone, melatonin, very recently isolated, is an antagonist of the pituitary's melanocyte-stimulating hormone and is biologically active as a skin lightening agent. These findings appear to refute the belief in the pineal's lack of function. It also has all the morphological attributes of a secretory gland, having a rich vascular and neural network. It contains as much serotonin and histamine as other parts of the brain, and half its acetylcholine level. It also contains the enzymes required for both synthesis and destruction of serotonin and related amines, and it picks up more P^{32} than any other tissues, whilst its I^{131} uptake is second only to the thyroid itself. A new adrenotrophic hormone has been isolated and identified as glomerulotrophin (GTH), probably a lipid since it is soluble in the fat solvent hexane. It is suggested that the pineal gland represents an atrophied immature pituitary which in primitive life controlled homeostasis.

BOMBAY UNIVERSITY DEPARTMENT OF CHEMICAL TECHNOLOGY

THE University of Bombay will be celebrating shortly the Silver Jubilee of its Department of Chemical Technology. The Prime Minister, Shri Jawaharlal Nehru, is expected to inaugurate the celebrations on January 3, 1960.

The Department was started in 1934 for the admission of 20 students to a two-year degree course for the B.Sc. Tech. in Textile Chemistry and Chemical Engineering following the degree of B.Sc. in Chemistry. The late Dr. R. B. Forster of Leeds University was the first Head of the Department. Under the leadership of Professor K. Venkataraman, who was Director during 1938-57, further courses were added in 1943 in the Technology of Pharmaceuticals and Fine Chemicals; Food Technology (initially Chemistry of Foods and Drugs); Technology of Intermediates and Dyes; Technology of Oils, Fats and Waxes; and Technology of Plastics, Paints and Varnishes—later changed into two separate courses: Technology of Plastics and Technology of Pigments, Paints and Varnishes. A four-year course in Chemical Engineering for the degree of B.Chem.Eng. which replaced the B.Sc. (Tech.) course was instituted in 1951. A three-year course in Pharmacy for the degree of B.Pharm. was instituted in 1958. In addition to its normal academic functions of teaching and research, the Department helps industries by carrying out research and analyses on their behalf.

The Department has, since its inception, made commendable progress. The total number of students has risen from 20 in 1934 to over 500 in 1959 and the teaching staff from 6 to 37. Over 1,500 students have so far graduated in Technology and some 300 students have received research degrees.

THE ANTIGENICITY OF DOLICHOS ENATION MOSAIC VIRUS

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A VECTORLESS, sap transmissible virus disease of *Dolichos lablab* L. was reported from Poona.[1] Subsequently this disease was noticed in Mysore and Madras States. The disease shows marked reduction of leaf blade caused by the suppression of growth in the interveinal areas, with the characteristic enations appearing on the lower side of leaves. These authors discussed the affinities of Dolichos enation mosaic virus (DEMV) and suggested that it resembled tobacco mosaic virus (TMV) in physical properties, Bean mosaic viruses 4 and 4 A in thermal inactivation and Pea streak virus in dilution end-point. By cross-protection tests in White Burley tobacco evidence was obtained that DEMV was not related to TMV[2] and was confirmed here by preliminary serological tests with TMV antiserum.

An attempt to test DEMV for its antigenic properties was, therefore, made and is reported here.

Seeds of *Dolichos lablab* (variety DL 231) which were kindly supplied by The Millet and Pulses Specialist, Agricultural College, Coimbatore, were raised in ordinary garden soil in 4" earthen pots, with 1-2 seeds. The plants were kept in a well illuminated greenhouse, with temperature around 30° C. Plants were kept in insect-free conditions through rigid nicotine spraying twice a week. The primary leaves of plants were inoculated with standard extract (a known fresh weight of infected leaves mixed with an equal volume of water, *i.e.*, 1 g. of leaf + 1 ml. of distilled water), using an abrasive 'Celite'. The leaves were sap-inoculated in the usual manner.

Precipitin reaction was carried out in short thick-walled tubes, half-immersed in a water-bath held at 37° C. for over a period of 1 hour. All serological reactions were carried out with 0·85% saline for dilutions.

Fresh leaves of systemically infected *Dolichos lablab* plants 15-20 days after inoculation, with leaves showing prominent mosaic symptoms, were collected and standard extract prepared. About 6-8 ml. of infective sap, in a thin-walled test-tube was heated for 10 min. in a water-bath maintained at 60° C. and the sap cooled immediately in cold water, thus ridding sap of plant proteins which was centrifuged for 15-20 min. at 3,000-3,500 r.p.m. The clear brown supernatant was dialysed against running tap-water for over an hour, the sap again centrifuged for 15 min. The pH of this clarified infective sap was around 5·7 and was used for immunizing rabbits. An aliquot of the same was inoculated against *Nicotiana glutinosa* and *Dolichos lablab* to test for possible TMV contamination.

A course of six intravenous injections of 1-3 ml. of the clarified infective sap at intervals of 3 days were given to an 'Albino rabbit'. The animal was bled ten days after the last injection and the blood centrifuged for 30 min. at 3,500 r.p.m. to give a clear antiserum.

The antiserum was tested against both healthy and diseased *D. lablab* sap to ascertain specificity of antiserum to DEMV. While a negative result was obtained with healthy plant sap, there was a clear specific positive precipitate in reaction to infected sap. The amount of antibodies present in antiserum to DEMV was then estimated. A two series dilution of antiserum, with a factor of five, was prepared using saline, one of the series forming saline control mixture. At a known dilution of standard extract of antigen (DEMV) at 1/5 and recording the time of precipitation in precipitin reaction, over a period of 30 min. it was possible to obtain a high titre value of 1/625, as shown in Table I. Antiserum of DEMV gives a dense granular precipitate suggesting that DEMV is likely to be a spherical particle.[3,4] A negative result was obtained when antiserum of DEMV was tested with TMV, suggesting that the two viruses are serologically not related. Antiserum

TABLE I

Showing titre value of antiserum to DEMV

	Antiserum to DEMV									
	1/1	1/5	1/25	1/125	1/625	1/1	1/5	1/25	1/125	1/625
Dilution of DEMV 1/5	++	++	−	−	−	−	−	−	−	−
	+++	+++	++	+	+?					
	++	+	+	−	−	−	−	−	−	−
	++++	+++	++	++	++					
	+++	++	++	+	+*	−	−	−	−	−

\+ : relative amount of antigen. * after 1 hour incubation.

to DEMV was mixed with an equal volume of glycerol (i.e., 50%) and stored in narrow mouthed glass-stoppered dustproof bottles at — 4° C. for future use.

I thank Prof. T. S. Sadasivan for discussions. It is a pleasure to also thank my colleague Mr. A. Ramadas for assistance.

I thank the National Institute of Sciences of India for award of a Senior Fellowship during the tenure of which this work was carried out.

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PHYSICS OF THE SOLID STATE

THE International Summer School on Physics of the Solid State was held at the Cavendish Laboratory of the University of Cambridge from 15th July to 13th August, 1959, under the Directorship of Professor N. F. Mott, F.R.S. Over 80 members were selected to attend the School of whom about 60 came from different countries. The School was financed by the funds of the Ford Foundation which also provided the travelling grants to many members of the School.

The subjects, covered by the course, could be divided under the following general headings: introductory lectures, theory of dislocations and point defects, chemical methods of observing dislocations, observation of dislocations by electron microscopy, applications of dislocation theory, contrast effects on electron micrographs of crystalline materials, electron and X-ray microscope techniques, colour centres in ionic crystals and mechanical properties of ionic crystals, defects in crystalline polymers, growth of crystals from the melt, and numerical calculations on dislocations and point defects. Seven visiting scientists and thirteen members of the University of Cambridge, delivered the courses of lectures.

Arrangements were made to set up, under the direction of group supervisors, study sections consisting of about twelve members to clear up difficulties arising with the academic side of the course. On three or four days a week, the afternoon sessions were mainly devoted to demonstrations, visits to laboratories and discussion of group meetings.

The introductory lectures on dislocations were given by Professor N. F. Mott. Dr. J. W. Mitchell (Bristol) gave the details for observing the dislocations by chemical methods. A series of lectures on the theory of defects and dislocations in Solids, was delivered by Dr. J. Fridel (Paris). Dr. M. J. Whelan (Cambridge) explained the principles of electron diffraction by crystalline materials and their applications in the interpretation of contrast effects on electron micrographs of crystals.

After outlining the techniques of electron and X-ray microscopy, recent advances in the design and construction of electron microscopes which have enabled details below 10 AU to be resolved, were explained. The use of replica techniques in the study of metal specimens with the electron microscope was illustrated with a description on the methods of preparation of replicas. Dr. P. B. Hirsch (Cambridge) dealt with the low temperature plastic properties of face centred cubic crystals and the observation of dislocation in thin films. Dr. A. Kelly (Cambridge) described the types of precipitation found in Aluminium and Copper with an account of X-ray and magnetic methods used to study the process of deformation in the interior of crystals. Current theories of the interaction of dislocations, with coherent precipitates were advanced. Dr. P. L. Pratt (Birmingham) spoke about the mechanical properties of ionic crystals.

Professor A. H. Cottrell (Cambridge) delivered a series of lectures on theory of fracture. The effects of "quenching" the metals, the techniques for growing crystals with high purity and perfection, the mechanical properties of such crystals, dislocations in semiconductors and twinning in crystals, formed the subject-matters of the other lectures. Dr. A. Seeger (Stuttgart) presented the methods that have been developed for quantitative calculations of the properties of dislocations and other defects. He also reported the results of such calculations on some physical problems.

It is not possible to include all the details of the lectures given during the course of the Summer School. But it is hoped that the above summary indicates the common grounds of interest found by the members working in such diverse fields as metallurgy and nuclear physics, in the course on Physics of the Solid State.

Tata Institute of Fundamental Research, Bombay-5. R. VIJAYARAGHAVAN.

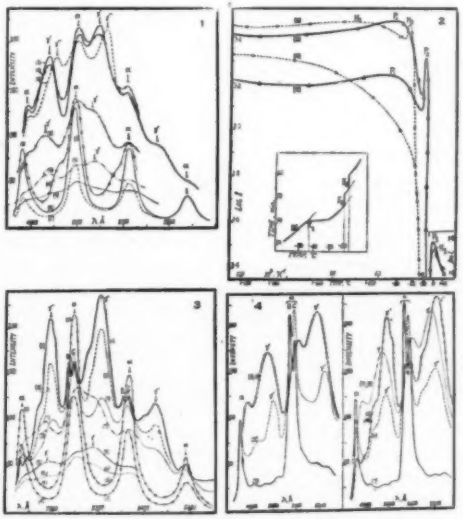
LETTERS TO THE EDITOR

TEMPERATURE DEPENDENCE OF FLUORESCENCE BANDS OF URANYL NITRATE SOLUTIONS

RECENTLY Hayakawa and Hirata[1] have reported intensity variations in the fluorescence of uranyl nitrate solutions. They observe two peaks in the T-I curve at $-85°$ and $-25°$ C., of which the latter is ascribed to melting. We have been interested in quantitative measurements of intensities in these spectra for some time now and one of us had earlier observed several complex changes in the T-I curves,[2] the elucidation of which needed further detailed study. We are now in a position to report the specific conditions under which these intensity changes take place.

What is of profound significance is that for the solution of a given pH and concentration the spectrum not only depends upon temperature, but also upon the manner in which the solution is brought to that temperature. Spectral changes in the range $+25°$ to $-193°$ C. have been studied in six different ways: (*a*) Slow warming of a solution rapidly cooled to $-193°$ C., (*b*) Slow warming of a solution previously slowly cooled to $-193°$ C., (*c*) Slow cooling from $+25°$ to $-193°$ C., (*d*) Warming of a rapidly cooled solution to an intermediate temperature θ and recooling rapidly to $-193°$ C., (*e*) Warming of a slowly cooled solution to an intermediate temperature θ and recooling rapidly to $-193°$ C., and (*f*) Slow cooling up to an intermediate temperature θ and rapid cooling further up to $-193°$ C.

Figure 1 represents the spectral changes in case (*a*). The spectrum at $-193°$ C. contains α and γ bands and the intensity variations of these with temperature are shown in Fig. 2. The curve for α bands shows three peaks: P_1 ($-75°$ C.)*, P_2 ($-20°$ C.) and P_3 ($-2°$ C., melting point). The curve for γ bands similarly shows three peaks: H_1 ($-120°$ C.), H_2 ($-60°$ C.) and H_3 ($-2°$ C.). Just at H_2 the γ bands shift towards the red (Fig. 1, Curve 3), after which they disappear rapidly. They can hardly be traced in the range $-35°$ to $-5°$ C. and then they reappear in the original γ position. In the range H_3 to $+25°$ C. their intensity falls less rapidly than that of α bands. Curve 5 in Fig. 2 (inset) shows the variation of temperature with time for a conc. (4 M)† solution. It shows three discontinuities: K_1 ($-43°$ C.), indicating an exothermic change; K_2 ($-20°$ C.) indicating an endothermic change; and K_3 ($-17°$ C.), corresponding to melting in this case. The correspondence between K_1 and the steep fall



FIGS. 1–4. Fig. 1. Fluorescence spectra of rapidly cooled 0·2 M aqueous solution of Uranyl Nitrate at different temperatures during warming: (1) $-193°$ C., (2) $-75°$ C., (3) $-60°$ C., (4) $-45°$ C., (5) $-30°$ C., (6) $-20°$ C. (7) $-10°$ C., (8) 0° C., (9) $+25°$ C. (I scale for 7, 8. 9, to read 1/50). Fig. 2. Temperature-Intensity curves (T-I curves) for different bands during warming from $-193°$C. Curves (1), (2) for α, γ bands respectively of rapidly cooled solution. Curves (3), (4) for α, γ' bands respectively of slowly cooled solution. Curve (5) shows variation of temperature with time for a rapidly cooled 4 M solution. Fig. 3. Fluorescence spectra of slowly cooled 0·2 M aqueous solution of Uranyl Nitrate at different temperatures during warming: (1) $-193°$ C., (2) $-100°$ C., (3) $-75°$ C., (4) $-35°$ C., (5) $-20°$ C., (6) $-10°$ C., (7) 0° C., (8) $+25°$ C. (I scale for 6, 7, 8 to read 1/60). Fig. 4. Fluorescence spectra at $-193°$C.: (1), (2), (3) and (4) for rapidly cooled solution warmed up to $-100°$, $-45°$, $-20°$ and $-10°$ C. respectively and recooled rapidly; (5). (6), (7) and (8) for slowly cooled solutions warmed up to $-100°$, $-45°$, $-20°$ and $-10°$C. respectively and recooled rapidly; (9) and (10) for solutions cooled slowly up to $-30°$ and $-45°$ C. respectively and rapidly cooled thereafter.

* Temperatures in the lower range may be in error by 5° C.

† Changes are not so distinct in 0·2 M solution for which the spectra have been taken.

in γ intensity, as also between K_2 and peak P_2 in α intensity, is notable.

In case (*b*) a well-resolved spectrum is obtained at $-193°$ C., containing α bands (split into two components, B and C) and γ' bands (shifted towards the red w.r. to γ). The spectral changes are given in Fig. 3 and T-I variations in Fig. 2. The T-I curve for γ' shows no noticeable hump. In case of α bands the intensity at $-193°$ C. is rather low and peak P_2 is very prominent. It may be observed that up to $-80°$ C. (about P_1) the C component of α gains over B. Case (*c*) differs from (*b*) in the conspicuous absence of peak P_2.

The spectra observed at $-193°$ C. under processes (*d*), (*e*) and (*f*) are given in Fig. 4. The notable features are that by warming the frozen mass up to different intermediate temperatures θ (below melting) and then recooling (*i*) the spectrum of a rapidly cooled solution can be changed to that of a slowly cooled one and *vice versa*, (*ii*) the ratio of C to B components can be changed and (*iii*) the intensities of γ and γ' bands relative to α can be reduced to any extent. The critical values of θ are related with discontinuities K_1 and K_2 (Fig. 2, Curve 5). For example, a rapidly cooled solution warmed to θ between $-43°$ to $-20°$ C. on recooling gives a resolved spectrum, the γ' bands diminishing in intensity with increasing θ.

Details will be published elsewhere. One of us (H. D. B.) is thankful to the Council of Scientific and Industrial Research for financial assistance.

Department of Physics, D.S.B. Govt. College, Naini Tal,
November 6, 1959.

D. D. PANT.
D. P. KHANDELWAL.
H. D. BIST.

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DAY-LIGHTING EQUATIONS FOR A STANDARD OVERCAST SKY

EQUATIONS for sky factors for a "Uniform sky" were derived by Yamauti[1] (1924) using a geometrical method. Those equations were used by Rivero[2] (1958) in the preparation of his tables for a rectangular window of known dimensions.

The International Commission on Illumination (C.I.E.) in its sessional meeting at Zurich[3] (1955) defined and recommended for general adoptation a "Standard Overcast Sky" in which the surface intensity of illumination varied with the altitude in accordance with the equation $B_\theta = B_z(1 + 2 \sin \theta/3)$, where B_z and B_θ were the intensities at zenith and at an altitude θ respectively. Tables of sky components for this standard overcast sky were also drawn up by Rivero[2] (1958) based on his initial tables of sky factors for a uniform sky and using an indirect method of computation.

The author has now derived rigorous trigonometrical equations which can be employed directly. For a point P on the normal to the plane of the window passing through one of its lower corners and distant D from it, the equations

$$L/D = \tan \beta, \quad H/D = \tan \gamma,$$
$$\tan \beta' = \tan \beta \cos \gamma\,; \quad \tan \gamma' = \tan \gamma \cos \beta$$

define the angles β, β', γ and γ' subtended at P by the lower and top horizontal sides and nearer and farther vertical sides respectively of the rectangular window of length L and height H. In terms of these angles the derived equations for the different sky components at the point P for a C.I.E. Standard Overcast Sky, for a vertical rectangular unglazed window opening are as follows:

$$F_h = \frac{3(\beta - \beta' \cos \gamma)}{14\pi} + \frac{2 \sin^{-1}(\sin \beta \sin \gamma)}{7\pi} - \frac{1}{7\pi} \sin 2\gamma \sin \beta'$$

$$F_{v\perp} = \frac{3(\gamma - \gamma' \cos \beta)}{14\pi} + \frac{2}{7\pi}(1 - \cos \beta - \cos \gamma + \cos \beta \cos \gamma)$$

$$F_{v\parallel} = \frac{3(\gamma' \sin \beta + \beta' \sin \gamma)}{14\pi} + \frac{2}{7\pi}(\sin \beta - \cos^2 \gamma \sin \beta')$$

where F_h, $F_{v\perp}$ and $F_{v\parallel}$ are the sky component ratios in the horizontal plane, vertical plane perpendicular to the window and vertical plane parallel to the window respectively, passing through P. The angles are expressed in radian measure.

It is also possible to use the same equations to determine the sky components at any other point not on the perpendicular from one corner of the window.

The first terms in the equations above, but with $1/2\pi$ replacing the factor $3/14\pi$ are the respective Yamauti's equations for a uniform sky. Those equations are also derivable by the general analytical method adopted by the author.

Derivations of the equations and tables of calculated sky components using them are given in a paper shortly to be published.

Central Building Research Institute, Roorkee, *November* 18, 1959. T. N. SESHADRI.

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A PROBABLE KREITTONITE

LIGHT to skyblue crystals of high hardness (more than 7·5) and specific gravity of 4·5, are collected from the pegmatites of Acari, Rio Grande do Norte state of Brazil. They are taken as guide mineral for Casseterite deposits, and are considered hitherto as lazulite. In paragenetic association are muscovite, cleavelandite, casseterite, tourmaline and tantalite.

They show on close examination, fine crystals of octahedrons, with some deformations. The mineral under the microscope is isotropic, and has a varying high index of refraction, with some grains showing $1{\cdot}790 \pm 0{\cdot}002$, and the rest higher than the available liquids (1·795).

X-ray photographs showed the following 'd' values for the intense lines (Table I).

TABLE I

Sample 1	Sample 2
2·90	2·89
2·475	2·468
1·573	1·566

Sample 1 has been considered as gahnite, and sample 2, as hercynite. Both the samples show the major elements Zn, Al and Fe, and the minor elements Ca and Ti, under the spectroscope.

In the studies made on Brazilian minerals by X-ray diffraction, Tavora (1955) records data on a gahnite and a hercynite from Bahia. Table II includes these data and also the A.S.T.M. for comparison.

There is close similarity between the above results of the Zn, and Fe members of the spinel series. The sample studied from Acari shows marked variation and fair deviation from the values in Table II. Also the presence of Fe and Zn in the majors suggests the mineral as a species in between the end members of the spinel series. The unit cell values are also differing from the values of pure gahnite and hercynite. It is, as such, possible that the mineral is either an iron gahnite or a zinc hercynite. The chemical analysis showed the iron content as 20%. Thus it is suggested that the mineral could be classed as Kreittonite (ferriferroan gahnite from Bodenmais, Bavaria, with total iron oxide 22%).

TABLE II

Gahnite (Tavora)	Gahnite (A.S.T.M.)	Hercynite (Tavora)	Hercynite (A.S.T.M.)
2·86	2·85	2·87	2·87
2·44	2·42	2·45	2·45
1·577	1·55	1·562	1·56

Detailed chemical work is under progress and will be published elsewhere.

Thanks are due to Dr. John J. Matzko, who has kindly arranged the X-ray photos taken in the D.N.P.M., Rio de Janeiro, by M. Augusto Bptista.

Mineralogical Laboratory, Instituto de Geologia Universidade do Recife, Recife, Brazil, *October* 24, 1959. A. BHASKAR RAO.

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SOME CARDIOVASCULAR EFFECTS OF *DAEMIA EXTENSA* IN DOGS

Introduction.—*Daemia extensa* (Ver.—Sanskrit : *Uttaravaru*, Bengali : *Chagulbarta*, Tamil : *Veliparuthi*) is a permanent twining herb distributed throughout the hotter parts of India. The plant has been used for various maladies in Ayurveda.[1,2]

The plant contains 2·4% of inorganic salts, a bitter resin and three bitter substances. Bitter principle C is the most active pharmacologically. It has a stimulant action on uterus, intestines, and other smooth muscles due to direct action on the smooth muscles,

Gupta and co-workers,[4,5] studying the pharmacological actions of the active principles of *Dœmia extensa* on cats, guinea-pigs and frogs, have mentioned that it stimulated involuntary muscles and raised the blood pressure.

Effects of the active principles on dogs probably have not been studied before. The present work is undertaken to study some aspects of the effect of *Dœmia extensa* on the Cardiovascular System of dogs.

Cardiovascular effects of Dœmia extensa.—Both aqueous extracts and alcoholic extracts (both 1 in 10 strength) were tried on mongrel dogs of varying weights. Anæsthesia was induced either with Chloralose i.v. (100 mg./kg.) or paraldehyde (1 c.c. per pound). Respiration was recorded by Mary's Tambour. General blood pressure was recorded from the carotid artery. Femoral vein was cannulated for injection of drugs. Peripheral blood pressure was recorded from the femoral artery as per Rolf's technique. Myocardiogram was recorded in 5 dogs. The carotid artery was ligated in the middle and into the portions above and below the ligature polythene tubings were introduced; that going headwards was manipulated to reach as near the carotid sinus as possible, as evidenced

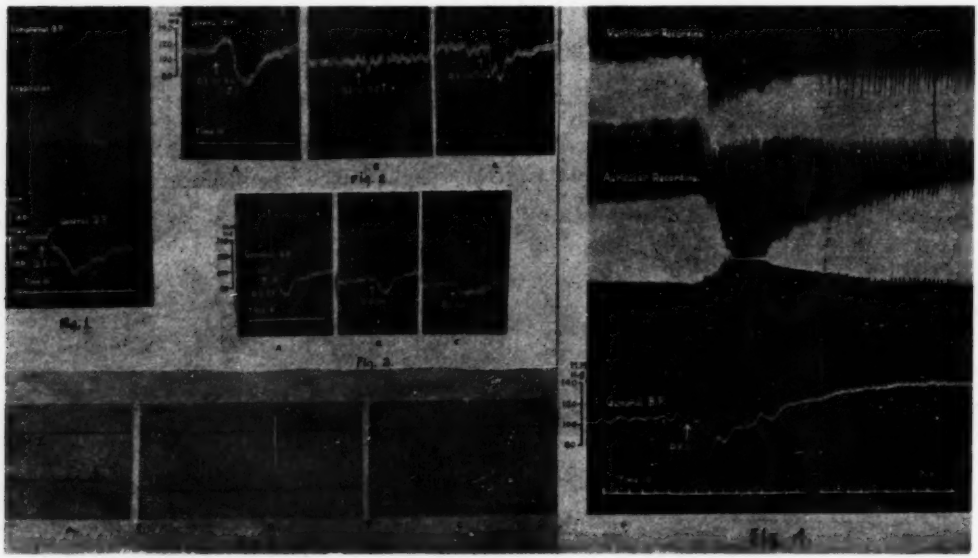

FIG. 1. Dog, 20 lbs. male, Chloralose Anæsthesia. Recordings from above downwards are Peripheral blood pressure, Respiration. General blood pressure and time in 10 seconds. At the arrow, 1 c.c. of alcoholic extract of *Dœmia extensa* was given i.v. (Femoral). A small rise followed by a very steep and prolonged fall of blood pressure of about 40 mm. is noted. Respiratory effect is probably a result of the fall of blood pressure.

FIG. 2. Dog, 18 lb. male, Chloralose Anæsthesia. Recordings of blood pressure and time markings are shown. In (A) the effect of *Dœmia extensa* (1 c.c.) injected i.v. into the jugular vein is shown. There is a very steep fall of blood pressure. In (B) *Dœmia extensa* (1 c.c.) was injected into the Carotid Artery, towards the head. No effect is seen on the blood pressure. In (C) *Dœmia extensa* (1 c.c.) was injected into the Carotid Artery towards the heart. There is a definite fall of blood pressure.

FIG. 3. Dog, 12 lb. female, Chloralose Anæsthesia. Recordings of general blood pressure and time markings are shown. In (A), *Dœmia extensa* (1 c.c.) was injected into the Femoral vein resulting in a fall of blood pressure. In (B), *Dœmia extensa* (1 c.c.) was administered a few minutes after TEA (25 mgm.) was given. The hypotensive effect is diminished. In (C), *Dœmia extensa* (1 c.c.) was administered after Atropine (5 mgm.) was given a few minutes earlier. The fall in blood pressure is reduced but not completely annulled.

FIG. 4. Dog, 20 lb. male, Chloralose Anæsthesia. Recordings show from above downwards Ventricular and Auricular Myocardiograms, General blood pressure and time markings in 10 seconds i.v. Administration of *Dœmia extensa* (1 c.c.) produced immediate auricular depression, some ventricular depression, and general fall of blood pressure.

FIG. 5. Dog, 20 lb. female, Chloralose Anæsthesia. E.C.G. Lead 1 was recorded. In (A), normal E.C.G. Lead 1 is shown. In (B), after *Dœmia extensa* (2 c.c.) i.v., considerable slowing of heart rate is seen. In (C), after *Dœmia extensa* (9·8 c.c.) Ventricular arrhythmia is to be noted.

by physical check up at the sinus region; the other one going towards the heart was manipulated to reach as near the heart as possible, the position being checked up later. The external jugular vein was also similarly cannulated and the tubing adjusted to reach the left auricle. Drugs were injected into these polythene tubings and the effect on carotid chemoceptor and higher centre as separate from myocardium was studied. E.C.C. was also recorded.

Whatever was the preparation of *Dœmia extensa* used, aqueous or alcoholic, the effect on blood pressure was always the same. Sometimes, there was a small initial rise in blood pressure. However, after injection, there was constant fall of blood pressure and an augmentation of respiration. This fall of blood pressure was not abolished by TEA (by ganglionic block) or Atropine (peripheral parasympathetic block). No fall of peripheral blood pressure was produced when the drug was injected locally. Injection of the extract through the polythene tubings into the carotid artery towards the head did not produce much effect on blood pressure. But Intra-carotid injection of the extract towards and close to the heart similar to intrafemoral (venous) and intrajugular injections produced immediate fall in blood pressure. Myocardiographic records show a depression of the auricles immediately after injection. Electrocardiographic records show invariably ventricular tachycardia. The fall of blood pressure appears to be chiefly due to a direct depressant action on the heart.

The alcoholic extract is more potent than aqueous extract. About 20-25 c.c. of a decoction of 10 gm. of dried powdered leaves in about 100 c.c. of distilled water is enough to kill an average dog. With alcoholic extract (1 in 10). the dog dies even after about 5-8 c.c.

Summary.—The active principles of *Dœmia extensa* seem to have a definite depressant action on the myocardium in dogs.

Our thanks are due to Mr. S. Gopalan, Pharmacist, for help in this work.

Madurai Medical College, Madurai, *August* 25, 1959.

M. N. Guruswami.
Lalitha Kameswaran.

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EFFECT OF ADRENALINE AND ANTISTINE ON CILIARY MOVEMENT IN RELATION TO ACETYLCHOLINE CONCENTRATION IN FROGS OESOPHAGEAL MUCOSA

Since the inhibitory effect of adrenaline on different segments of rat intestine has been observed by us to vary with the acetylcholine content of the tissues[2] and that the rate of acetylcholine has been shown to regulate the ciliary movement,[4] it is not unlikely that the inhibitory effect of sympathomimetic amines and antihistaminics on the ciliary movement might also be related to acetylcholine synthesis in the œsophageal mucosa. It was therefore thought worthwhile to investigate if this effect of adrenaline and antistine on the rate of ciliary movement and acetylcholine content of œsophageal mucosa in frogs was also mediated through the inhibition of acetylcholine synthesis.

Adult *Rana tigrina* frogs, weighing between 200-250 gm., were divided into three groups. Group I frogs were injected with only normal saline to serve as control while groups II and III were given adrenaline and antistine in 1 mg./kgm. and 50 mg./kgm. doses respectively. Injections were made into the dorsal lymph sac 15-20 minutes before starting the observations.

The rate of ciliary movement was determined from the time taken by poppy seeds to travel a measured distance on the ciliary mucosa of the œsophagus exposed through dorsum in decapitated and pithed frog as described by Burn.[4] Acetylcholine content of the œsophageal mucosa containing the cilia was estimated biologically on frog rectus as detailed in our previous communication.[1]

The effect of adrenaline and antistine on the average rate of ciliary movement and the acetylcholine content per gram of œsophageal tissue is summarised in Table I.

The average values presented in Table I indicate that the rate of ciliary movement as well as acetylcholine content of œsophageal mucosa is significantly reduced after 1 mg./kgm. and 50 mg./kgm. doses of adrenaline and antistine respectively. As the percentage reduction in both these effects has been in the same direction it is likely that these drugs might be acting through inhibition of acetylcholine synthesis which is known to influence both the rate of ciliary movement (*loc. cit.*) as well as acetylcholine content of the tissues.[3] In another series of *in vitro* experiments both adrenaline and antistine in $0{\cdot}2 \times 10^{-6}$ concentration

TABLE I

Showing the average rate of the ciliary movement and acetylcholine content of œsophageal mucosa after adrenaline and antistine

Group	Drug	Average rate of ciliary movement (cm./min.)	Reduction of ciliary movement from the control (%)	Average Ach. content of œsophageal mucosa (μ/gm.)	Reduction in Ach. content of œsophageal mucosa from the control (%)
I	Normal saline 0·5 c.c. control	3·84 (±·48)	..	0·68 (±·098)	..
II	Adrenaline (1 mg./kgm.)	2·56 (±·52)	33·3	0·333 (±·075)	51·5
III	Antistine (50 mg./kgm.)	2·05 (±·20)	46·6	0·283 (±·05)	58·8

(which was 5 to 10 times the concentration estimated to be present in œsophageal mucosa after parenteral administration of these drugs) were ineffective in causing any significant inhibition of acetylcholine induced contraction of frog rectus. It is therefore likely that the marked inhibitory effect of adrenaline and antistine on the ciliary movement might be affected through their influence on the *in vivo* synthesis of acetylcholine in the tissues.

Department of Pharmacology, Gandhi Medical College, Bhopal, *October* 24, 1959.

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SPECTROPHOTOMETRIC STUDIES OF PENICILLIN SALTS IN RELATION TO THEIR STABILITY

COMMERCIAL preparations of penicillin are expected to maintain their potency within the pharmacopœial limits for a period of 3 to 4 years from the date of their certification. The pharmacopœial limits are 10% lower than the theoretical potency to allow for natural fall in potency on storage. However, commercial samples have been observed to have varying degrees of stability. We have made a systematic study of commercial products in regard to their keeping qualities and with a view to determine the cause, mechanism and the degradation products, of the deterioration.

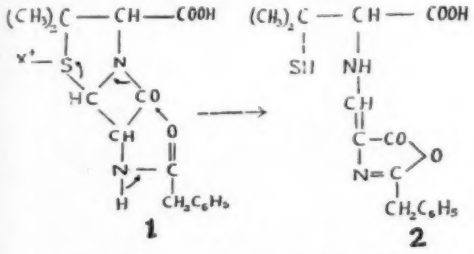
There have been a number of passing references[1,2,5] to a penicillin degradation product which has an ultraviolet absorption peak at 320 mμ, reported to be present in sodium penicillin samples. The identity of this impurity with benzylpenicillenic acid, an isomerisation product formed by mercuric chloride isomerisation of penicillin, as also by heating an aqueous penicillin solution at pH 4·5, is well established. However, there is no report in literature regarding the influence of this impurity on the keeping quality of the soluble salts of penicillin.

Pure penicillin preparations have characteristic absorption peaks at 252, 257·5 and 264·0 mμ and none at 320 mμ. In our survey with a large number of batches of sodium penicillin G over the last two years, it was noticed that the keeping quality of the samples depended on their initial absorbance at 320 mμ. Some of the commercial preparations showed an absorption peak at 320 mμ, with varying values of E (1%, 1 cm.). It was found that the samples which have an absorbance of more than 0·07 (when determined according to British Pharmacopœa—a 0·18 w/v solution in water) or E (1%, 1 cm.) at 320 mμ more than 0·392, do not keep very well, the loss in potency being as high as 15% in 2 years.

Samples with very high initial absorbance at 320 mμ, deteriorated from initial potency of 1,640 u/mg. to 1,590 u/mg. in the course of a month. All the cases where the absorbance was less than 0·07 were stable for more than 2 years. Spectrophotometric study of the batches at regular intervals indicated that the absorbance of 320 mμ progressively increased in the case of deteriorating batches while it remained steady in the case of stable samples. This indicates that the impurity which is the cause of the decomposition is also the product of decomposition. This was confirmed by isolation of benzylpenicillenic acid by fractional

crystallisation. This product had a molar extinction of 18,000, agreeing with the value reported by Carpenter *et al.*[3]

An extra acid group is liberated from penicillenic acid (2), which explains the fall in pH observed in the case of decomposed samples.



1 2

Benzyl penicillin Benzyl penicillenic acid

The mechanism of isomerisation of penicillin to penicillenic acid (a stabler structure) has been described,[1,4] but the mechanism of acceleration of the decomposition of penicillin in presence of even traces of this material is not understood. Moisture determinations of the various batches under study did not show any significant increase in the moisture from the original values, thus ruling out the possibility of a hydrolytic type decomposition.

In Table I are given E (1%, 1 cm.) at 320 mμ the original potency and the potency after 2 years, of some of the samples. Fuller details of this study will be published elsewhere.

TABLE I

Sl. No.	E(1%, 1 cm.) at 320 mμ	Original potency μ/mg.	Potency after 2 years μ/mg
1	0·500	1650	1540
2	0·670	1660	1431
3	0·570	1650	1540
4	0·580	1651	1503
5	0·181	1650	1615
6	0·151	1643	1607
7	0·169	1653	1613
8	0·181	1650	1615

Our thanks are due to Dr. K. Ganapathi for his encouragement and interest in this work.

Plant Laboratories, Hindustan Antibiotics Ltd., Pimpri, *August* 14, 1959.

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CHEMICAL PROPERTIES AND CHANGES DURING STORAGE OF SOME INDIAN RAY LIVER OILS*

RAY liver oils are used in leather industry and the yield of oil from fresh good livers ranges from 30-35%. About 4,500 tons of rays are landed annually on the Indian coast. The present note reports the results of investigations on the constants and storage conditions of ray liver oils as the available data about them are scanty.

The fresh livers from the rays landed at Uchipilli, Adirampatnam and Mandapam Camp during December to June 1957-58 were taken and boiled with sufficient quantity of water and the clean yellow oil was ladled and filtered. The yield of the clean yellow oil was 30% and the residual oil was 5%. After the removal of stearine by the cold clearing process the chemical constants were determined by the A.O.A.C. methods. The commercial samples collected at Adirampatnam are mixtures of liver oils of *Dasyatis sephen* and *Rhinoptera* sp. The constants for the liver oils extracted in the laboratory and that of the commercial samples are given in Table I, along with the constants for the Philippine Ray liver oils for comparison.

All the oil samples were stored in plain bottles at the room temperature (27-30° C.) and the iodine value, acid value, peroxide value and the free fatty acids were determined at regular intervals to study the extent of deterioration during the storage period. The results are given in Table II.

It is seen from Table I that the acid values and peroxide values are significant in the commercial oil samples which may be due to improper method of preparation. The liver oils obtained from the *Dasyatis* sp. possess the required characteristics for preparation of sulphonated products.[1] The results in Table II indicate that there is a gradual increase in the acid value, free fatty acids and the peroxide value of the oil during the 5 months storage period. The fall in the iodine value is also

* Published with the permission of the Chief Research Officer, Central Marine Fisheries Research Station, Mandapam Camp.

TABLE I
Physical and chemical constants of fresh ray liver oils

Constants	Ray liver oils extracted in the Laboratory		Mixture of liver oils from *Dasyatis sephen* + *Rhinoptera* sp.		Philippine Ray liver oils (2)		
	Dasyatis sp.	*Aetomylaeus maculatus*	Commercial sample I	Commercial sample II	*Dasyatis sephen*	*Dasyatis uarnak*	*Dasyatis kuhlii*
Oil content ..	30·45%	30·35%	20·45%	20·45%	19·8%	30%	23·9%
Refractive index at 25° C. ..	1·475	1·4660	1·470	1·4735	1·4721	1·4756	1·4700
Specific gravity at 25° C. ..	0·92	0·907	0·920	0·912	..	..	..
Saponification value ..	188	197·20	195·50	192·40	168	188	170
Iodine number (Hanus) ..	140	68·63	120·30	134·1	118	127	88
Unsaponifiable matter ..	1·64%	7·65%	1·78%	2·26%	4·8%	3·0%	7·6%
Acid value ..	0·31	0·23	4·31	3·33	..	..	..
Water-soluble fatty acids ..	0·70%	0·12%	0·195%	0·22%	..	..	..
Water-insoluble fatty acids ..	95·5%	88·08%	84·55%	76·96%	..	..	..
Moisture ..	0·1%	..	..	..	..	..	..
Colour of the oil ..	Golden yellow	Bright yellow	Light brown	Light brown	..	..	..
Peroxide value ..	Nil	Nil	2·30	3·40	..	..	..
Free fatty acids (expressed as Oleic)	0·16	0·14	2·17	1·67	..	..	..

TABLE II
Changes during storage

Sample	Storage period (days)	Acid value	Free fatty acids (expressed as Oleic)	Iodine value (Hanus)	Peroxide value†	Remarks
Ray liver oil ..	32	0·37	0·16	140	Nil	..
Dasyatis sp. ..	76	0·57	0·19	134	Nil	..
	133	0·95	0·48	125	14·09	..
	150	0·96	0·49	124	15·0	..
Aetomylaeus maculatus ..	60	0·34	0·17	67·04	11·53	..
	90	0·27	0·13	62·04	15·00	..
	120	0·72	0·36	65·98	20·16	..
Commercial sample I ..	60	5·18	2·61	108·5	21·91	..
	90	6·33	3·19	102	49·53	Sample discarded
Commercial sample II ..	60	3·45	1·74	132	20·17	..
	90	5·18	2·61	118·4	40·45	Sample discarded after 3 months

† Number of ml. of ·002 N thiosulphate required for 1 gm. of fat.

significant during this period. Excepting the peroxide value of the oil, the values of other constants still agree with the constants required for the preparation of sulphonated oils for use in the leather industry even after 5 months storage. It is not clearly known whether the rancidity of the oil has any adverse effect for its use in the leather industry.

I am thankful to Dr. S. Jones for his keen interest in the investigation. I am also thankful to Shri N. K. Velankar for his suggestions.

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PRELIMINARY NOTE ON AORTIC AFFECTIONS WITH FILARIAL PARASITES IN LOCAL OVINES

So far the known records of filarial worms occurring in the aorta of Indian livestock are only those of *Onchocerca armillata* Railliet and Henry, 1909, in cattle and *Elœphora pœli* (Vryburg, 1897) infestations in buffalo. The

former, according to Baylis (1939), was first described, but not named, by Lingard in India but has since been reported by Gaiger (1915), Neveu-Lemaire (1912), Bhalerao (1935), Baylis (1939) and Varma (1953) from different parts of the country while the latter has only been recorded once by Varma (1953) from Assam.

During collection work from a local slaughterhouse, one of us (S.M.S.) noticed in a goat carcass in its bulbous aorta and the anterior part of thoracic aorta an unusually large swelling which, when incised, showed on its intima a number of nodules of different sizes and uneven character, with central depressions and ulcerations all round. Somewhat stout but pinkish coloured worms, lying partly or wholly embedded, were easily detected over such areas against the intimal background which, at such spots, was thickened and contained below it a yellowish cheesy mass. There were hæmorrhagic spots at the affected site. However, a very large blood clot of nearly 4 cm. in diameter and 1·25 cm. raised above the general surface carried a number of worms with their protruding parts hanging into the lumen and showing distinct movement. The completely embedded specimens proved to be much younger forms. In all fifteen worms were collected. A well-defined buccal capsule with eight distinct papillæ on its peri-buccal margin was present. Male specimens were 1·5-2·81 cm. while the females were 2·8-4·4 cm. in length. On another occasion two worms, one of each sex, were collected. The more developed males have the characteristic features of the external genitalia and in the more developed female specimens the vulva, vagina and uteri had developed but there were no eggs or microfilaræ.

From study of the buccal capsule, two dissimilar but simple spicules, gubernaculum and caudal papillæ in males and in the position of the vulva in the œsophageal region, the specimen are assignable to the subfamily Diptelonematinæ, Wehr., 1935 of Setaniidæ, Skrjabin and Shikhobolova, 1945. The type genus *Diptelonema* Diesing, 1861 has been extensively studied, among others, by Chabaud (1952) and Webber (1955) and in the literature the names of the allied genera, *Deraiophorenema* (Romonowich, 1916), *Tetrapetalonema* (Faust, 1935), *Acanthocheilonema* (Cobbold, 1870) are found but because the validity of a few of these has been questioned a confusion exists. Yeh-Liang-Sheng (1957) has proposed re-classification of this and related genera. Following him, the present specimens are provisionally identified as *Tetrapetalonema* sp.

The examination of five other cases from the aorta yielded specimens of *Onchocerca armillata* which was also encountered in sheep but only female worms were recovered.

This is the first record of dipetalonematid filarioid from aorta of goat and cases of aortic onchocerciasis in goat and sheep.

The authors are grateful to Prof. B. P. Pande for guidance, supervision and many criticisms in the preparation of this manuscript.

Department of Parasitology, U.P. Coll. of Vet. Sci. & Animal Husbandry, Mathura, *August* 31, 1959.

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STUDIES ON THE DEVELOPMENTAL VARIATION OF AWN IN RICE

Literature on awning in rice refer to such environmental factors as plentiful water-supply, drought conditions, spacing between plants, manuring, etc., affecting awn development. Observations have also been recorded on secondary awning where certain varieties with no awns in the primary panicles develop awns in secondary panicles. The phenomenon of normally awnless varieties producing awns in ratoon crop also comes under the above category. Preliminary studies on the importance of external factors on awn development are recorded here.

A field grown to variety Co. 13 (a short term, non-photo-sensitive and normally awnless variety) was harvested by middle of April and the field was irrigated. Out of 2,342 stubbles 312 sprouted of which 95 survived to flower. All the ratoon plants showed varying extent of awn development.

Another observational trial consisted of pruning the roots before transplanting in an awned variety Ptb. 7, a pure line selection, giving 45-50% awned grains in a panicle. Seedlings of

this variety were transplanted in pots some with the roots intact and others with roots completely pruned. In the series with root-pruned seedlings, the plants had to be supported by stakes in the beginning but subsequent growth was as good as the other series with normal seedlings. It was interesting to note that in pruned series the awn development was restricted (Fig. 1,

FIG. 1

Ptb. 7 A, normal Ptb. 7 B, roots pruned). The average length of awn worked out to 0·78 cm. in the pruned plants as against 1·42 cm. in normal. The percentages of awned grains were found to be 31 and 47·9 respectively. The same phenomenon was also observed in another trial with the tetraploid of another pure line, SR. 26 B. Here in the normal plants the percentage of awned spikelets was found to be 73·96 and the average length of awn was 1·44 cm. In plants with roots pruned, however, the corresponding figures were 68·22 and 0·87 cm.

The secondary awning observed in Co. 13 has no relation to sensitivity to photoperiod since the variety itself is non-photo-sensitive. The shoot growth however was restricted compared to the root system which developed on the mother plant and remained intact on the ground. This differential development of root and shoot may be one of the factors evoking the expression of awn. In the case of Ptb. 7 and SR. 26 B the delay in root development due to pruning might have inhibited development of awn. It is thus seen that a delayed root development tends to suppress awn in normally awned varieties; in varieties which normally do not develop awns a delayed shoot growth (as in Co. 13 example above) results in its expression. The genetic factors affecting awn development perhaps need for their stability, a specific physiological balance as between shoot and root development and the upset of this balance affects awn expression.

Detailed studies on the above aspects are being initiated.

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ON *SIMARUBACEOXYLON* SHALLOM AND ITS SYNONYMY WITH *SIMARUBINIUM* PLATEN

RECENTLY Shallom[1] has described a fossil wood from Mahurzari in the Deccan Intertrappean Series and has assigned it to a new genus *Simarubaceoxylon* Shallom. However, there already exists a form genus for the woods of Simarobaceæ. As long ago as 1907, Platen[2] had established the genus *Simarubinium* for the fossil woods of this family. This name should have priority over the new name propounded by Shallom. Accordingly *Simarubaceoxylon mahurzari* Shallom should be renamed as *Simarubinium mahurzari* (Shallom) com. nov.

Further, Sprague[3] has pointed out that the correct spelling of the family commonly referred to as "*Simarubaceæ*" is "*Simaroubaceæ*". It would be better if this spelling is adhered to in referring to this family.

Birbal Sahni Institute of Palæobotany, R. K. JAIN.
Lucknow, *September* 23, 1959.

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EFFECT OF FERTILIZER PLACEMENT WITH INOCULATED SEED ON GROWTH AND NITROGEN FIXING POWER OF SUB-CLOVER (*TRIFOLIUM SUBTERRANEUM* L.)

VINCENT (1958) reviewed the lethal effects on root nodule organism (*Rhizobium* Sp.) of the inoculated seed when placed in direct contact with fertilizers and insecticides. The effect of such direct placement of different fertilizers with inoculated seed on growth, nodulation and nitrogen fixing power of the host legume has, however, not been reported. The results of an experiment carried out to obtain this information is reported below.

A pot experiment was designed with two major treatments: (i) Direct placement of fertilizer with inoculated seed, and (ii) Indirect placement, whereby a layer of soil was put in between the fertilizer and the inoculated seed. Six types of fertilizers used, *viz.*, (A) superphosphate, (B) Superphosphate *plus* Calcium carbonate 1 : 1, (C) Di-calcium phosphate, (D) Di-calcium phosphate *plus* Calcium carbonate 1 : 1, (E) Calcium carbonate, and (F) Potassium sulphate formed the six minor treatments, replicated four times. Five hundred grams of sterile soil was placed in a small pot, and on the surface of the soil equidistant from the centre, four holes were made with a glass rod (about 8 mm. diameter and 4 mm. depth). Calculated amounts of the fertilizer at the rate of 1 cwt. per acre foot of the soil were placed in each hole and two inoculated seeds of Subterranean Clover were placed directly on the fertilizer or after covering the fertilizer with a layer of sterile soil, as the case may be. The germination of the seed and the growth of the plants were satisfactory, and the pots received water as and when found necessary. The plants were carefully lifted when 76 days old, nodules on roots counted, dry weights of the whole plants per each pot determined and nitrogen in the plant estimated. The protein value is computed by multiplying total nitrogen of the crop by 6·25. These results presented in Table I clearly show that (i) the effect of indirect placement of fertilizer on nodule numbers, dry matter and total protein is significantly better than direct placement; (ii) irrespective of the nature of placement or the type of fertilizer there is a positive correlation between the nodule count and dry matter production; and (iii) superphosphate as well as di-calcium phosphate have a significant beneficial effect on all the three characters studied over other fertilizers.

The superiority of indirect placement over direct placement is evident even by an observation of the crop growth in the pots as illustrated in Fig 1. These results indicate that the toxic effects of fertilizers on root nodule bacteria of the inoculated seed usually observed in the laboratory in petri dishes can be so severe, even in the soil, as to markedly affect nodulation, dry matter production and nitrogen fixation. This might be one of the reasons for the failure of inoculation in the field, and as such has an important bearing in field practice of drilling the inoculated seed and the fertilizer in the same drill row.

TABLE I

Major treatments placement	Minor treatments (Fertilizers) A	B	C	D	E	F	Mean
	Number of nodules per pot						
Direct	120	38	106	49	65	21	66·5
Indirect	152	128	154	116	129	80	126·5
Mean	136	83	130	82·5	97	50·5	..
	S.E. due to placement effect ± 7·39; S.E. due to fertilizer effect ± 9·05						
	Dry matter mg. per pot						
Direct	3484	1789	3167	1946	2063	1061	2251
Indirect	3350	3190	3666	2971	2629	2029	3006
Mean	3517	2489	3416	2458	2346	1548	..
	S.E. due to placement effect ± 191·7; S.E. due to fertilizer effect ± 234·8						
	Total Protein mg. per pot						
Direct	482	228	367	255	264	153	291·5
Indirect	463	409	485	370	302	253	382·9
Mean	472	318	426	317	283	203	..
	S.E. due to placement effect ± 12·79; S.E. due to fertilizer effect ± 22·15						

FIG. 1. Direct Placement of Superphosphate.
FIG. 2. Indirect Placement of Superphosphate.
FIG. 3. Direct Placement of Potassium Sulphate.
FIG. 4. Indirect Placement of Potassium Sulphate.

Details will soon be published elsewhere.

To Dr. I. D. Blair, Head of the Department of Microbiology, Canterbury Agricultural College, Lincoln, Christchurch, New Zealand, my grateful thanks are due for suggesting the problem and helpful guidance. Grateful thanks are also due to the Government of New Zealand for the grant of a fellowship under the Colombo Plan which enabled this study.

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July 15, 1959.

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STUDIES ON AVAILABLE COPPER IN SOME INDIAN SOILS

SEVERAL workers[1–3] have employed the bioassay method of Mulder[4] for determination of available copper in different soils with considerable advantage. The method is highly sensitive and shows good correlation with actual plant response or appearance of deficiency symptoms. This method as modified by Nicholas[5] was used for the determination of available copper in some representative Indian soils from some of the important soil groups.

The 'M' strain of *Aspergillus niger* was used for assay. In order to get an idea of the percentage availability of copper in the different soils, these were also analysed for their total copper content by the improved method of Cheng and Bray.[6] The results obtained are presented in Table I. They show that the different soils have a wide range of variation in their available, total, as well as per cent available copper content.

TABLE I

No.	Location	Soil group	Available copper μg./g. soil	Total copper μg./g. soil	% available copper
1	I.A.R.I., New Delhi	Alluvial	1·7	12·5	13·6
2	Pusa (Bihar) ..	do.	1·7	14·0	12·1
3	Indore ..	Black	5·0	60·0	8·3
4	Angul (Orissa) ..	do.	6·5	33·5	19·1
5	Bhubaneswar ..	Red	0·9	11·5	7·8
6	Bangalore ..	do.	2·7	27·0	10·0
7	Travancore ..	Peat	9·0	50·0	18·0

The alluvial soils appear to be similar in their available and total copper content. The values for available copper are low and reflect conditions of slight deficiency for copper according to the classification used by Donald *et al.*[7] Plants growing on these soils might not exhibit symptoms of copper deficiency but might respond to copper application. The red soils particularly that from Bhubaneswar, also show low values for available as well as total copper content. It has been observed that the citrus plantations, in the Bhubaneswar area from where the soil sample was collected, do not thrive well. The low copper content of the soil together with its low availability might be an important factor contributing to this problem. The black soils have given higher values as compared to the alluvial and red soils. These soils may not, therefore, show any response to copper application. The peat soil stands well in the region of non-deficiency and further application of copper may not give any response.

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Division of Soil Science and Agricultural Chemistry, I.A.R.I., New Delhi, *July* 10, 1959.
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A NOTE ON THE TECHNIQUE OF INFECTING LARVAE OF *CORCYRA CEPHALONICA* STAINTON (LEPIDOPTERA: GALLERIIDAE) WITH GREGARINE PARASITES*

In the course of experiments for assessing the effect of gregarine parasites on the secretion of the digestive enzymes in *Corcyra* larva, the author needed a constant supply of 'infected' larvæ in large numbers. Though sometimes the larvæ collected from stored rice bags were found to contain gregarine parasites in their gut, they were seldom heavily infected. A novel method was, therefore, developed in order to ensure a heavy infection of *Corcyra* larvæ with gregarine parasites. Large numbers of eggs obtained in the laboratory from fertilized female moths were mixed up with the food material of the larvæ under rearing, most of which were already infected with gregarine parasites. Rearing was done in an incubator at 34° C., in glass jars (8½" × 6½") filled to about three-fourths of their capacity with coarsely milled 'Jowar' mixed with 5% of powdered yeast, and their mouths covered over with muslin cloth. As the infected larvæ grew the cysts of the gregarine parasites began to pass out along with the excreta, and got mixed with the food, and the larvæ hatching out from the eggs introduced into the jars fed on this contaminated food and got infected. These larvæ in their turn passed out cysts of gregarine parasites along with their excreta and thus the contamination of the food and infection of the larvæ continued. Such contaminated food material was mixed with fresh food supplies and distributed into different jars, in which fresh eggs were introduced, so that the larvæ feeding on this contaminated food got heavily infected with gregarine parasites. The photomicrograph (Fig. 1) gives an idea of the intensity of infection of the larvæ reared in this way.

FIG. 1. Photomicrograph of the longitudinal section of the mid-gut of infected larva, showing large number of gregarine parasites.

I am grateful to Dr. P. D. Gupta for his kind guidance and interest in the work, and to Professor M. B. Lal for the provision of laboratory facilities and finally to the Government of India for the award of a Research Training Scholarship.

Department of Zoology, P. N. Srivastava.
Lucknow University,
Lucknow, *July* 23, 1959.

* Part of the thesis approved for the degree of Doctor of Philosophy of Lucknow University in 1958.

PHORONIS ARCHITECTA ANDREWS FROM THE VELLAR ESTUARY AT PORTO NOVO

Gravely[1] briefly reported the occurrence of a single specimen of *Phoronis* from the collections of the Krusadai Island. Recently Nair and Shaw[2] described the occurrence of *Phoronis australis* Haswell from the Kathiawar Coast of India. The occurrence of *Phoronis* in the Coramandel Coast of India has not been reported so far, although the *Actinotrocha* larva is quite common in the plankton.

Recently, while surveying the bottom fauna of the Vellar estuary at Porto Novo a number of specimens of *Phoronis* were dredged at a depth of 3 to 4 metres in the Vellar estuary about 2 kilometres from the mouth of the river at Station 'B' (Jacob and Rangarajan[3]). These specimens have the following distinctive features: (1) The formation of isolated tubes with sand grains incorporated into their walls. (2) The great development of the longitudinal muscles. (3) The presence of a ciliated groove in the digestive tract. (4) The relatively small number of tentacles (about 60). (5) The diœcious habit of the animal. These features show that this species is *Phoronis architecta* Andrews which was originally described by Andrews[4] from U.S.A.

The specimens inhabit slender isolated membranous tubes measuring 30-90 mm. and in a substratum consisting of about 1% coarse sand, 10·6% fine sand, 22·8% very fine sand, 65·6% clay and silt and 2·4% broken molluscan shells. The specimens were dredged when the salinity of the bottom water was as low as 18·02% and

as high as 30·62%. The tubes are rarely straight and their anterior ends do not project out from the mud. The animals vary in length from 10-30 mm. and the number of tentacles vary from 60-70. It is interesting to note that *Phoronis architecta* Andrews, originally described from the sea, is found in the estuary at Porto Novo.

FIG. 1. Photomicrograph of *Phoronis architecta*, ×32.

Blood vessels, septa, body wall, nervous system, alimentary canal and nephridia are like those of *Phoronis architecta* described by Brooks and Cowles.[5] However, the Porto Novo specimens differ from the American specimens in the following features: (1) The pinnate longitudinal muscle layer is very well developed as in *Phoronis buskii*. (2) The lophophoral organ is a small simple structure and not a complex one. (3) The longitudinal ridge of ciliated gland cells is present in the œsophageal and prestomach regions only. These features may not be of taxonomic value.

My thanks are due to Prof. R. V. Seshaiya, Director, for help and guidance and to the Ministry of Education, Government of India, for the award of a research scholarship.

K. BALASUBRAHMANYAN.

Marine Biological Station,
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OCCURRENCE OF *OZOBRANCHUS MARGOI* APATHY (HIRUDINEA: ANNELIDA) IN THE INDIAN SEAS

THE genus *Ozobranchus* de Quatrefages, as recently revised[1] includes six valid species, of which only three, *i.e.*, *O. shipleyi* Harding., *O. papillatus* Kaburaki and *O. polybranchus* Sanjeeva Raj, are known from India.

The Mediterranean-species, *O. margoi* Apathy, diagnosed by its five pairs of digitiform gills, was first collected literally in thousands in 1889 and 1894 on the heads of *Thalassochelys corticata* in the Bay of Naples.[2] Later, after a long interval, in 1927, two specimens were taken on *Caretta olivacea* on the coast of Fukoka and two more specimens were taken earlier by Oka[3] quite unusually on a dolphin (*Delphinus longirostris*) from the Sea off Sagami.

In February 1957, over a thousand specimens of *O. margoi* were collected from underneath the right forelimb of a single *Eretmochelys imbricata*, captured alive by the Madras Fisheries Department on the coast of the Bay of Bengal at Ennore, 12 miles north of Madras. The collection includes individuals of all sizes varying between 5·0-19·5 mm. in total length. No cocoons were noticed on the host.

Apathy's original description of this species is unavailable to-day. Oka's account, however inadequate, and Selensky's[4] comparative anatomical studies are valuable. The latter published in Russian is not easily accessible. Hence there is a need for a detailed account of the morphology and anatomy of this interesting species. This is being prepared for publication elsewhere.

The present record of *O. margoi* Apathy, extends its parasite-host distribution as well as its geographic distribution to the Oriental region also.

Department of Zoology, P. J. SANJEEVA RAJ.
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INHERITANCE OF THE PURPLE CRESCENT ON THE STANDARD PETAL OF *ARACHIS HYPOGAEA* LINN.

THE standard petal of the flower of *Arachis hypogœa* has a purple crescent at the base from which radiate purple lines. There are variations in the intensity of colouration of the crescent in the different varieties, ranging from complete absence to a prominent pattern. This character has been utilized for classification of varieties and types by Hayes[2] and John *et al.*[3] Five grades of colouration of the crescent have been recognised. The complete absence of the crescent has been noted in an Australian white-seeded bunch variety (A.H. 6742) (Bhavanishankar Rao and Srinivasalu[1]). The commonly raised bunch and spreading types have a distinct crescent on their standards. The inheritance of this character was studied at the Agricultural Research Station, Tindivanam and the results are reported in this note.

FIG. 1. Standard Petal of *Arachis hypogœa*.
A—Crescent present; B—Crescent absent.

TABLE I
Inheritance of purple crescent on the standard petal of Arachis hypogœa

Cross No.	Female parent	Male parent	F. 1	F. 2 No. of plants	
				With crescent	Without crescent
691	A.H. 6742	A.H. 25 (Saloum)	Crescent present	303	22
692	do.	A.H. 477 (Bassi)	do.	191	8
694	do.	A.H. 2105 (Native Tanganyika)	do.	14	1
695	do.	A.H. 45 (H.G. 1)	do.	109	7
696	do.	Forma Erecta	do.	57	4
		Total observed		674	42
		Expected on 15 : 1 ratio :		671·25	44·75

$\frac{X^2}{m} = 0{\cdot}18.$

P = between 0·70 and 0·50.

Crosses were effected between the Australian white bunch with no crescent and a number of other varieties with distinct and well-defined crescent. The hybrids exhibited the crescent, thereby indicating the dominant nature of the character. The F. 2 population was raised and individual plants were studied for the exhibition of this character. The data on segregation fitted into a double hybrid ratio showing that the character is controlled by two factors.

The results are given in Table I.

The types with no crescent have usually stems devoid of anthocyanin pigment and the seed colour is also white. From studies on the different varieties of *Arachis hypogœa*, it may be said that the anthocyanin pigmentation on the stem is correlated with the presence of crescent on the standard. It is also interesting to note that the inheritance of pigmentation on the stem is also controlled by two factors (Patel *et al.*[4]).

We are thankful to Sri. P. Krishnaswamy, Superintendent, for providing necessary facilities for the study and for guidance.

Agri. Res. Station, Tindivanam, *July* 17, 1959.

N. SRINIVASALU.
N. S. LOGANATHAN.

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CYTOLOGY OF SOME HIMALAYAN MOSSES—II

IN an earlier communication,[1] the writer reported the chromosome number of 25 Himalayan Mosses not worked out previously. In this report some more families have been worked out and the study has been extended to a number of other localities particularly Darjeeling, Eastern Himalayas. The name of locality is mentioned against each species in Table I.

As the Mosses are a poor storage material for cytological studies, almost all the species were investigated in the field from July to September except *Trematodon sabulosus*, *Physcomitrium cyathicarpum* and *P. repandum* which are the mosses of the plains, and fruit in winter. It was discovered that the Mosses

work better if they are squashed without prefixation. This minimized the clumping of the bivalents which is a serious obstacle in counting. Therefore, for most of the Mosses the fresh sporogonia were squashed. The results are summarized in Table I.

TABLE I

	Name of the species	Locality	Meiotic chrmosome number
	DITRICHACEÆ:		
1	*Ditrichum tortile* (Schrad.) Lindb.	Mussoorie and Darjeeling	14 (13+*m*‡)
2	*D. heteromallum* (Hedw.) Britt.	Darjeeling	13
3	*Ceratodon stenocarpus* Bruch and Schimp.	do.	13 (14, 15)
	DICRANACEÆ:		
4	*Trematodon sabulosus* Griff.	Hoshiarpur	15
5	**Dicranella heteromalla* (Hedw.) Schimp.	Darjeeling	13
6	*D. viridissima* C. Muell	Mussoorie	16
7	*Camptylopus gracilis* (Mitt.) Jaeg.	Darjeeling	13
8	*C. letus* (Mitt.) Jæg.	do.	12
9	*C. gongkii* (Mitt.) Jaeg.	do.	*c* 12
10	*C. pyriformis* (Schulz.) Brid.	do.	*c* 12
11	*Oreoweisia laxifolia* (Hook.) Par.	do.	14 (13+*m*)
12	*Symblepharis helicophylla* Mont. var. A.	do.	14 (13+*m*)
	var. B.	do.	14 (13+*m*)
	LEUCOBRYACEÆ:		
13	*Octoblepharum albidum* Hedw.	do.	13, 26
	CALYMPERACEÆ:		
14	*Syrrhopodon gardneri* (Hook.) Schwaegr.	do.	13
	POTTIACEÆ:		
15	*Didymodon rufescens* (Hook.) Broth.	do.	13
16	*Barbula coruosa* Doz. et Molk. Subsp. *ganyeticum*	do.	14 (13+*m*)
	GRIMMIACEÆ:		
17	*Rhacomitrium javanicum* Doz. *et* Molk	do.	14 (13+*m*)
	FUNARIACEÆ:		
18	*Physcomitrium cyathicarpum* Mitt.	Amritsar	51+1−2 *f*
19	*P. repandum* (Griff.) Mitt.	do.	51+1−2 *f*
20	**Funaria hygrometrica* Hedw.	Darjeeling	28
	BARTRAMIACEÆ:		
21	**Philonotis turneriana* (Schwaegr.) Mitt.	Mussoorie	6

The chromosome number for the above species is being reported for the first time except those marked * ‡. '*m*' stands for the minute bivalent chracteristic of many bryophytes.

The two species of *Physcomitrium* show highest grade of polyploidy (Fig. 1), yet reported for an Indian species of this genus.

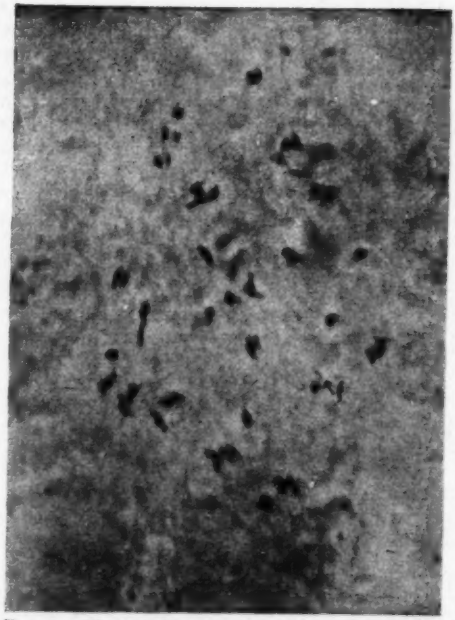

FIG. 1. Microphotograph of *Physcomitrium cyathicarpum* showing 51 bivalents and a fragment (*f*). ×1,70).

The writer gratefully acknowledges the encouragement given to him by Prof. P. N. Mehra during the course of investigation. He is indebted to Messrs. R. S. Chopra (Botany Department, Panjab University) and A. H. Norkett (British Museum, Natural History, London) for their kind help with the identification of the above species. Thanks are also due to Mr. R. S. Pathania for the microphotograph of *Physcomitrium cyathicarpum*.

Botany Department, K. R. KHANNA.
Panjab University,
Amritsar, *July* 2, 1959.

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AN ASPECT OF GAMMEXANE (HEXACHLORO-CYCLO-HEXANE) EFFECT ON CHROMOSOMES

THE importance of gammexane as a polyploidising and chromosome-breaking chemical has been well amplified (D'Amato, 1949, 1950). Its property as such stands comparison with that of colchicine.

However nothing is known yet as to the permanency of the effect of gammexane. Experiments were planned to test the effect of this chemical on root tissues subjected to prolonged and short treatment following recovery in water or Knop's medium. As some very significant results have been obtained an immediate announcement has been thought desirable.

As toxicity was found to be caused in higher concentrations, young bulbs of *Allium cepa* were grown in a very low concentration, *viz.*, dec. 0007% solution of gammexane for 20 days at 30° C. In another set of experiments bulbs were transferred to Knop's medium after 7 days of treatment. Observations on root-tip squashes were made following aceto-orcein technique every 24 hours.

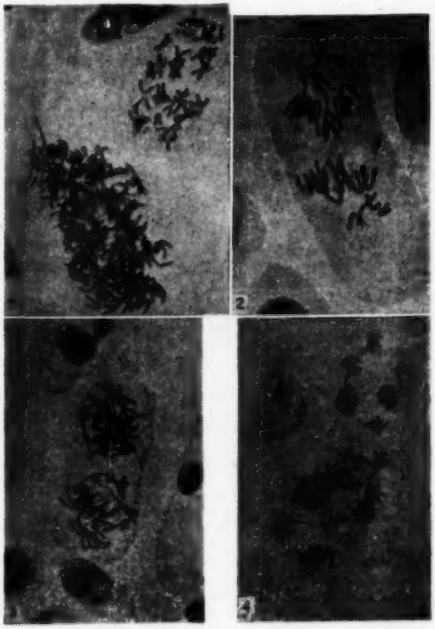

FIG. 1. A high polyploid cell, the other cell shows diplochromatids.
FIG. 2. Anaphase showing fragment.
FIG. 3. Somatic reduction showing double chromatids.
FIG. 4. Star metaphases and multinucleate condition.

Colchicine mitosis was noted after 24 hours and frequency of polyploid cells were found to increase with continued period of treatment. Degree of polyploidy too was found to increase considerably and after 144 hours it reached its maximum having more than 200 chromosomes in a cell. Tumour formation started after 3 days of treatment. Further keeping in gammexane solution gradually revealed somatic reduction as well as star metaphases within the cells resulting in multinucleate tissue. As many as 9 to 10 star metaphases could be counted in a single cell following 264 hours of treatment.

Gradually, the polyploid cells tended to decrease and after 480 hours of treatment, nearly all the dividing cells were found to be diploid. It is apparent that through the formation of star metaphases and somatic reduction cells with lower numbers are formed and those approaching the normal diploid condition survive. In addition to these irregularities, fragmentation and lagging too were not infrequently observed.

In another set in which recovery was performed in Knop's medium similar behaviour was noted excepting the fact that in Knop's medium, no other irregularities such as fragmentation, etc., could be detected.

The above results bring out clearly one remarkable aspect of gammexane effect manifested by the attainment of immunity of the tissue through somatic reduction and star metaphases following prolonged treatment in the chemical. It stands out markedly from colchicine in the transitory nature of its effect as the polyploidy once induced gradually reverts back to normal condition as soon as the influence of the chemical is removed.

The work has been carried out in a scheme sponsored by the Council of Scientific and Industrial Research, New Delhi, to which our thanks are due.

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Cytogenetics Laboratory,
Botany Department,
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Calcutta-19, *July* 24, 1959.

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A NOTE ON HEXAPLOID SORGHUM

KRISHNASWAMY *et al.*[1,2] reported certain abnormal types of meiosis in diploid grain sorghums and discussed the possibility of recovering from them octoploid, hexaploid and aneuploid plants. Subsequently, a hexaploid was obtained by dusting the stigma of desynaptic autotetraploid *Sorghum subglabrescens* ($2n = 40$) with the pollen from allotetraploid grain sorghum ($2n = 40$). This male parent has already been described in a previous paper.[3] The chromosome

number of the latter was determined by counts on root-tips as well as pollen mother cells. A brief description and behaviour of this hexaploid is presented in this note.

The hexaploid was vigorous, tall and tillering fairly. The lengths of the awn and glume were longer than those of the tetraploid mother. Pollen fertility was five times greater than in the pistil plant. The narrow base of the leaves, grains that were partly exposed and the brown wash on the reddish colour of the grain were noted particularly, as they were characters associated with the pollen parent.

The meiosis of the hexaploid revealed associations ranging from hexavalents to univalents (Maximum association, $2_{VI} + 4_{IV} + 14_{II} + 4_{I}$; minimum association, $15_{II} + 30_{I}$; Mean association per cell, $0{\cdot}44_{VI} + 0{\cdot}08_{V} + 2{\cdot}17_{IV} + 0{\cdot}61_{III} + 16{\cdot}2_{II} + 13{\cdot}76_{I}$) and did not show much abnormality. However, random distribution of the univalents or their division at anaphase, and formation of restitution nuclei were sometimes observed at interkinesis. At tetrad stage, it was noted that the cytoplasm gave rise to extra cleavages rarely. These bits of cytoplasm also enclosed a univalent, a fragment or no chromatin at all, thereby leading to the formation of supernumerary spores. The seed setting varied from 27·8% to 3·4% in the 13 panicles that were harvested.

This hexaploid is the product of fusion between an unreduced egg of the desynaptic autotetraploid *S. subglabrescens* and the reduced gamete of the allotetraploid grain sorghum. The hybrid origin of this hexaploid is further indicated by its characters like narrow base of the long leaves, partly exposed grains with the characteristic brown wash, etc., which are typical of *S. halepense*. The origin and cytological behaviour of the hexaploid suggest its auto-alloploid nature.

Cytogenetics Laboratory, Agric. College & Res. Institute, Coimbatore-3,
May 1, 1959.

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V. S. RAMAN.
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CHROMOSOME NUMBER IN SOME SPECIES OF HELIOTROPIUM

THIS note is a report of the chromosome numbers, as determined from the dividing pollen mother-cells, in *Heliotropium undulatum* Vahl, *H. strigosum* Willd., and *H. eichwaldi* Steud. Meiotic studies in *H. undulatum* and *H. strigosum* revealed 16 and 13 respectively, to be the haploid chromosome numbers of the species. The separation of chromosomes at anaphase I was regular in both the species (Figs. 1 and 2). As far as the authors are aware this is the first report of chromosome number in these species. The plants of *H. eichwaldi* showed 32 bivalents at diakinesis and metaphase I (Fig. 3).

FIGS. 1–3. (×710). Fig. 1. *Heliotropium undulatum*—Anaphase I showing sixteen chromosomes at either pole. Fig. 2. *Heliotropium strigosum*—Anaphase I with thirteen chromosomes on one side. Fig. 3. *Heliotropium eichwaldi*—Metaphase I showing thirty two bivalents.

The same number was counted at anaphase I and metaphase II. The observations regarding the chromosome count of *H. eichwaldi* are in conformity with an earlier report[1] where 32 was reported to be the haploid number of this species.

We are grateful to Principal, Dr. A. N. Banerji, for providing the necessary facilities.

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April 16, 1959.

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PUPA OF *OZOTOMERUS MACULOSUS* PERROUD (COLEOPTERA, ANTHRIBIDAE)

Ozotomerus maculosus Perr. is a sapwood borer. Recently on 13th February 1959, a few specimens of its larvæ and pupæ were extracted from a top dried sal (*Shorea robusta*) pole from Ranipokhri Vested Forests, Barkot Range, Dehra Dun Forest Division. Gardner (1932, 1936) has described its larva and Beeson (1919, 1941) and Mathur (1957) have given its distribution, food-plants and brief biological data. Its pupa is described below :

Pupa.—(Figs. 1 and 3) Length about 7·5 mm., width 3·0 mm. Uniformly white when newly formed. Tips of elytra roundly knobbed attaining the fifth sternite ; with a large, vertical knob-like papilla (Figs. 3 and 4) projecting just above the tip and beset with a brush of thick setæ ; some small papillæ also present in rows on the elytra. Metathoracic wings slightly longer than the elytra. Metathoracic tarsi extending well beyond tips of elytra and reaching up to the anterior portion of seventh sternite. Head ventral, rounded, thickly beset with hairs arising from short tubercles. Beak short and broad. Antennæ non-geniculate, lying transversely and reaching near to the postero-lateral corners of the prothorax. Prothorax somewhat dome-shaped and thickly beset with minute points ; anterior region armed with a row of setigerous tubercles, with scattered thick setæ and also sparsely provided with long hairs arising from minute tubercles (Fig. 2) ; antero-lateral angles armed with a bunch of long hairs ; posterior border prominent, moderately swollen and provided with a transverse row of fine hairs borne on minute tubercles ; a broad, shallow postero-median depression also present above the posterior border. Mesonotum moderately transverse. Metanotum broadly transverse, with a longitudinal median groove.

Skin of abdomen thickly beset with minute points. Abdominal tergites deeply grooved intersegmentally, first six tergites narrowly

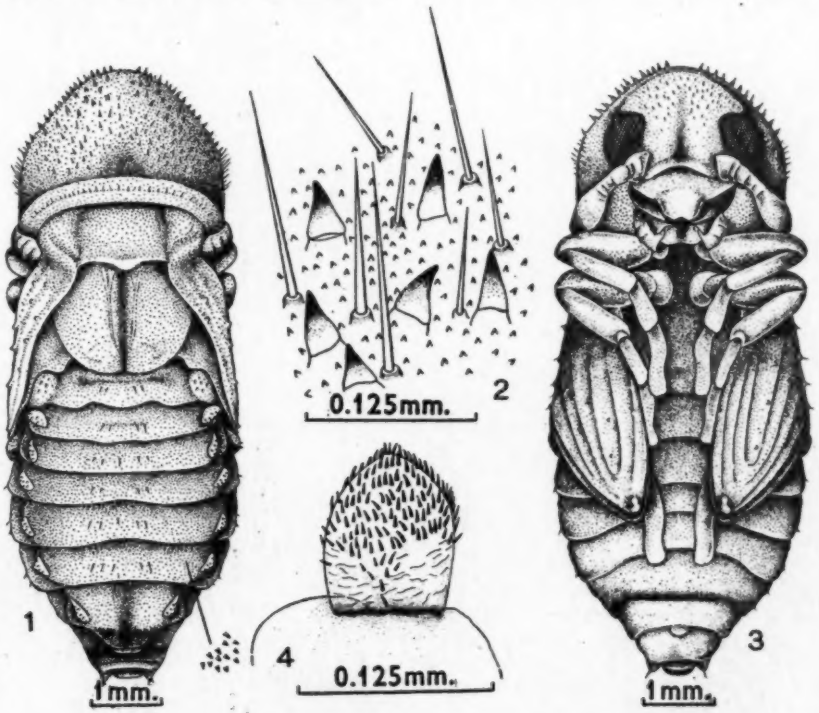

FIG. 1. Pupa of *Ozotomerus maculosus* Perr. ; dorsal aspect. FIG. 2. Various types of setæ on prothorax.
FIG. 3. Pupa of same ; ventral aspect. FIG. 4. A knob-like papilla near tip of elytra.

transverse, having a few fine median hairs, each tergite with a lateral ridge armed with a group of thick setæ and fine long hairs borne on small tubercles. Seventh tergite large, broad and transversely swollen in middle, sloping gradually both anteriorly and posteriorly, also with a deep longitudinal median groove, lateral ridges prominent and armed with thick setæ and a few fine hairs originating from small tubercles, posterior slope beset with a few fine hairs and thick setæ. Epipleural lobes each provided with two or three fine hairs. Ninth segment small, vertical, having a few fine hairs with two lateral processes armed with a few setæ. Tenth segment small and ventral to ninth segment.

Forest Research Institute, R. N. MATHUR.
Dehra Dun, *July* 18, 1959.

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SMICRONYX ALBOVARIEGATUS FAUST, CAUSING ROOT-GALLS ON *STRIGA* SPP.

DURING 1955 observations had been made of a weevil—*Smicronyx albovariegatus* Faust (Curculionidæ : Coleoptera), causing galls in stems and eating into the seed capsules of *Striga* (Khan and Murthy, 1955). Its seasonal history as occurring in the Nizamsagar Canal area of Nizamabad District, Andhra Pradesh, had also been included therein.

The present note is to record another mode of injury this weevil causes to the *Striga* plants. In the course of a tour in the Jowar-growing areas of Chamarajnagar Taluk in Mysore District in August 1959, and Gulbarga District in November 1959, the writer came across patches of *Striga* plants marked by pallor, and bearing fewer branches, flowers and seed capsules. A careful uprooting of the plants revealed the presence of a number of galls on the roots of these plants (Fig. 1). On dissection, a few galls revealed the presence of the grubs of *S. albovariegatus* though in the majority of cases the grubs had already emerged from the galls for pupation in the soil.

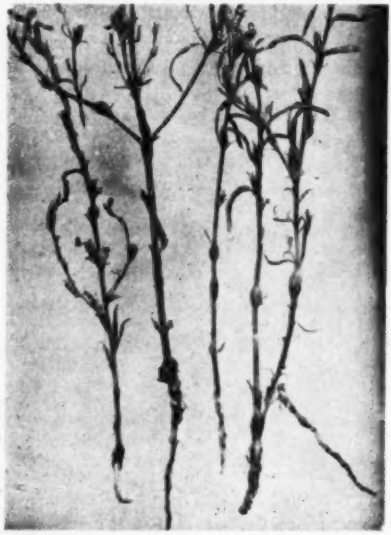

FIG. 1. *Striga* plants with both stem and root-galls.

It is seen that on account of the presence of root-galls there is a weakening of the *Striga* plant which may perhaps be due to the impaired absorption of nutrients due to root damage. In view of the fact that the weevil grub also destroys the seed capsules, *S. albovariegatus* may possibly exercise some degree of natural control of this phanerogamic root parasite in the field.

The writer is grateful to Dr. M. Puttarudriah for encouragement and guidance. The photograph was taken by Sri. P. Raghuram, Senior Artist, to whom the writer's thanks are due.

Division of Entomology, D. V. MURTHY.
Department of Agriculture,
Bangalore, *September* 15, 1959.

1. Khan, M. Q. and Murthy, D. V., *Ind. J. Ent.*, 1955, 17, Pt. III, 362.

REVIEWS

Principles of Statistical Techniques. A First course from the beginnings for Schools and Universities. By P. G. Moore. (Cambridge University Press), 1958. Pp. viii + 239. Price 22 *sh.* 6 *d.* net.

This is an elementary text-book on Statistics written for High School students and may be useful for University classes also. As the author states in the Preface, this book is an attempt to put across the main principles of statistical methods to students who are fundamentally interested in the practical applications of the subject and are not so much concerned with the philosophical bases of the concepts used. Mathematical ideas and symbols have therefore been reduced to a minimum and the book therefore will find its use especially to non-mathematical readers. The following chapter headings will give an idea of the contents of the book: (1) The Scope of Statistics, (2) The Collection of Data, (3) The Tabulation of Data, (4) The Pictorial Representation of Data, (6) Averages, (7) Measures of Dispersion, (8) Probability and sampling, (9) The Binomial Theorem, (10) Tests of Significance, (11) Further Tests of Significance, (12) Further Forms of Average, (13) Time Series, (14) Pairs of Characters.

V.

Mass Spectroscopy. By H. E. Duckworth. (Cambridge University Press), 1958. Pp. 206. Price 35 *sh.*

Mass spectrometers are nowadays commercially available instruments having applications mainly as an analytical tool. In its basic form, the instrument is a simple one in which charged ions undergo deflections in the presence of a magnetic field and undergo splitting according to their masses. Efficient operation of mass spectrometers demands a thorough knowledge of vacuum techniques, positive ion production and positive ion optics and detection methods. The positive apparatus of J. J. Thomson may be said to be the forerunner of the mass spectrograph which was first constructed and operated by Aston. Since then many improvements have been made to the original mass spectrograph, especially on the detection side. The monograph under review in its first chapter traces the development of mass spectroscopes and passes on to positive ion optics, sources of positive ions and detection methods in Chapters 2, 3 and 4 respectively. The next two chapters deal with deflection-type instrument and time of flight mass spectrometers. Chapters 6 to 10 deal with the applications of mass spectroscopy; determination of isotopic abundances; determination of atomic masses; application to nuclear research; ionisation and dissociation of molecules under electron impact. In the last chapter its application to geology is set out. In the appendix is given a table of naturally occurring nuclides, giving their isotopic abundances and masses. The monograph is a very good introduction to this very important technique.

A. J.

The Magneto-Ionic Theory and Its Applications to the Ionosphere. By J. A. Ratcliffe. (Cambridge University Press), 1959. Pp. x + 206. Price 40 *sh.* net.

In Professor S. K. Mitra's book on the Upper Atmosphere which was first published in 1947, there was an important section dealing with the propagation of electro-magnetic waves through an ionized medium in the presence of an external magnetic field on the lines of Appleton and Hartree's treatment of the subject. There have been important developments of the subject since then, and there was need for a comprehensive text-book dealing with the subject in a critical and physically understandable way. Prof. Ratcliffe's book well supplies the need.

The book is divided into four parts. In parts I and II, the equations of the magneto-ionic theory are derived with a clear statement of the assumptions. The equations are solved and the solutions are interpreted with the aid of numerous graphs both when there is no magnetic field and when there is a magnetic field. The effects of collisions and the nature of absorption in an ionized medium are discussed with great clarity. There is a chapter on group velocity in an ionized medium with and without magnetic field, a topic of great importance for determining electron density distributions in the vertical from ionospheric records.

In Part III, the equations and curves developed in the first two parts are applied to a model ionosphere. Some controversial questions such as triple splitting of ionospheric echoes and splitting near the gyro-magnetic frequency are discussed.

Part IV deals with a number of miscellaneous questions such as the Lorentz term in the magneto-ionic theory, the propagation of waves when there is a mixture of ions and electrons and the similarities and points of difference between propagation in a magneto-ionic medium and in a doubly-refracting crystal. The author gives reasons for preferring the Sellmeier theory, omitting the Lorentz term in the equations of the magneto-ionic theory. The problem of wave propagation in an inhomogeneous medium has not been dealt with in a mathematical way, but a descriptive account of the results of the wave treatment is given in Chapter 17.

The approach of Professor Ratcliffe is throughout from the side of physics. Physical ideas are kept in the foreground and they are built up step by step. Difficulties are anticipated and clarified. The implications of a mathematical result are examined in detail with an unstinting use of clear diagrams. The book is well printed and will be welcomed by all students of Ionospheric Physics.

K. R. RAMANATHAN.

Infra-Red Absorption Spectra. Index for 1945-57. By Herbert M. Hershenson. (Academic Press, New York and London; India: Asia Publishing House, Bombay-1), 1959. Pp. 11. Price $ 7.00.

The present volume forms a companion to the previously published *Ultraviolet and Visible Absorption Spectra*: Index for 1930-54. It contains about 16,000 references to published Infra-red Absorption Spectra in 33 important American and European journals, and one book. For finding the actual spectrum of any compound, the original reference cited must be consulted. With the increasing spate of literature on Infra-Red Spectra, such an index becomes—for the chemist and the Infra-red spectroscopist—a necessary addition to the library.

S. P.

Methods of Experimental Physics. Vol. I. *Classical Methods.* Edited by I. Estermann. (Academic Press, New York and London; India: Asia Publishing House, Bombay-1). 1959. Pp. 596. Price $ 12.00.

Teachers and students reading this book will find in it a series of enjoyable and readable survey articles of various topics in classical physics written at graduate level by various authors. Experimental research workers on the other hand, to whom the title of the series may conjure up visions of a worthy successor to Strong's classic, or Glazebrook's 'Dictionary' will be slightly disappointed with this first volume. According to the preface, however, the book was not intended to be 'a "cook book" giving detailed description of favourite recipes'. But it may also be questioned whether the cursory delineation or the theoretical bias found in some of the chapters have helped this volume to become 'a "guide book" which points out the advantages, capabilities and limitations of the various methods and thus enable the user to select those which appear appropriate to his particular problem'. Thus, Raman scattering is disposed away in half a page, without so much as a reference to the texts where the techniques relating to this field may be found. Then again, the chapter on Thermodynamics contains a purely theoretical discussion of the subject. However, even the critical reader must admit that the volume-like the curate's egg, is really good in parts, and so would be a useful addition to a scientific library.

S. P.

Analytical Chemistry of Polymers. Part I. Analysis of Monomers and Polymeric Materials Plastics—Resins—Rubbers—Fibres. Edited by Gordon M. Kline. (National Bureau of Standards, Washington. (Interscience Publishers), 1959. Pp. xviii + 666. Price $ 16·50.

This book presents for the first time a comprehensive account of the analytical methods employed for assessing monomers and polymers. The twenty chapters of the book cover the following subjects: Acrylic plastics, alkyds, aminoresins, cellulose derivatives, epox resins, ethylene and fluoroethylene polymers, furan resins, natural resins, phenolic resins, polyamides, polyesters, proteins, rubbers (elastomers), silicones, styrene monomers and polymers, vinyl polymers and copolymers, ion exchange resins, plasticizers, synthetic and natural fibres, and drying oils. The contributions are from chemists of well-known companies manufacturing monomers and polymers, such as the Hercules Powder Company, American Cyanamid Company, Shell Chemical Corporation, Union Carbide, Rohm & Haas, and Dow Chemical Company. Methods for the determination of impurities present in monomers are described, and analytical problems in investigating the chemical composition and physico-chemical properties of polymers are discussed. Except for some unpublished tests, procedural details are avoided and more attention is paid to basic principles, supplemented by numerous references to the original literature. Because of the extremely wide field which is covered, it is inevitable that some materials and methods have

been treated in considerably less detail than others. For instance, the three short paragraphs on the identification of synthetic and natural fibres by staining with dyes give no indication at all of the dyes that are actually employed or the basis on which the fibres are differentiated. Rosin and shellac, which are of special interest to this country, are dismissed with the sentence "Rosin and shellac are not included in the discussion of the natural resins". Cashew-nut shell liquid is not mentioned. Nevertheless, this is an invaluable reference book for chemists and technologists concerned with any aspect of monomers and polymers. A subsequent volume will deal with chemical group analysis, molecular structure determination and identification procedures for polymers.

K. V.

Combination of Observations. By W. M. Smart. (Cambridge University Press), 1958. Pp. 253. Price 35 *sh.* net.

Mathematical methods of interpreting experimental data are not only confined to the realm of physical sciences but have spread to such diverse fields as population studies, economics and biology. The difficulty of measuring a particular quantity with absolute accuracy can, to some extent, be overcome by making several independent observations and by combining these to give the most probable result. The book begins with the general principles of statistical theory and methods and then passes on to Error Theory. The basic concepts of the probability theory is provided in the 3rd chapter. In the 4th and 5th chapters are discussed the Measure of Precision. Later chapters discuss conditions involving general unknown quantities ; the representation of statistical distributions by mathematical functions ; exceptional measures and the correction of observed frequency distributions ; and finally the important question of correlating sets of two or more different observed quantities. The appendices give tables of the more important functions used in the combination of observations. Numerous examples from a wide range of disciplines give an insight to the readers as to how the different methods could be applied to practical cases.

A. J.

Metal Fatigue. Edited by J. A. Pope. (Chapman and Hall Ltd., London), 1959. Pp. xiv + 381. Price 70 *sh.*

The phenomenon of fatigue failure of metals and alloys has long remained "an enigma wrapped in mystery". The complex mechanism of fatigue failure is yet to be fully understood, but it is now common knowledge that such failures are brought about by the formation and extension of cracks in response to alternating or repeated stresses that are below the elastic limit. The design engineers are also aware of the fact that at least half, and perhaps very much more, of service failures in the components of high-speed machines are to be accounted for by metal fatigue. The best method of preventing such failures in future is to collect, study and use as much of experimental data as possible concerning the fatigue properties of common engineering materials. Most of the data in this field are obtained by accelerated fatigue tests in the laboratory and have to be correlated intelligently and carefully with actual service experience. The literature on this subject is growing and has perhaps to grow much more to be of reliable assistance to the design engineer. It is in this context that the present volume is very welcome as a reference book for the practising engineer.

This book derives from a week's residential course on the *Fatigue of Metals* held for professional engineers in the Engineering Department of Nottingham University in September 1955. Twenty lectures were given in this course by 15 experts drawn from both the industry and the University. The texts of these lectures are published here in three parts : (1) The fundamental of Fatigue ; (2) The Fatigue properties of engineering material and components ; (3) Fatigue testing of engineering components. The first part should be of interest to the advanced engineering student, the researcher as well as the design engineer, but the latter two parts are specially for the design and development engineer. The organizers of the course deserve warm congratulations for having undertaken the task of publishing the lectures in an attractive volume with numerous tables and illustrations carefully selected from recent publications. This book deserves to be in the hands of each and every designer.

T. R. ANANTHARAMAN.

The Chemistry of Natural Products. Vols. II and III. By P. de Mayo. (Interscience Pub., New York), 1959. Pp. vii + 320 and vii + 239. Price $ 7.50 and $ 6.00.

Next to steroids, recent studies in the field of terpenoids have promoted knowledge of cyclisation, rearrangement, substitution and elimination reactions, stereo-chemistry, absorption

spectra, rotation differences and rotatory dispersion. For some time the want of a textbook dealing with the latest developments in this field has been felt, and this has been very adequately met with by the recent two volumes of *"The Chemistry of Natural Products*—Vol. II *Mono- and Sesquiterpenoids* and Vol. III, *The Higher Terpenoids"*. Within the limit of remarkably short space the author—P. de Mayo —has developed the subject-matter in each chapter hardly missing any significant fact. The mode of presentation should make these volumes very valuable for teachers and students alike. D. K. BANERJEE.

Excursion Flora of the British Isles. By A. R. Clapham, T. G. Tunin and E. F. Warburg. (Cambridge University Press), 1959. Pp. xxxiii + 579. Price 23 *sh.* 6 *d.*

This handy reference book, as the name suggests, is designed to meet the demands of the student of systematics in his field studies and is a condensed form of the more voluminous work, the *Flora of the British Isles* by the same authors published in 1951. The present work, although as thorough and exact as the larger one, is more portable and cheaper, and can easily slip into the collecting bag. It includes, in addition to the descriptions, a sequence of orders and families and also a key to the families, both of which enhance the value of this little book very considerably as a work of ready reference. The descriptions of families and species are concise and clear, and the keys to the genera exact and precise. In order to save space the number of species dealt with in the larger *Flora* has been reduced here, and all text-figures have been omitted. Otherwise, the *Excursion Flora* has some improvements over the larger work, such as the inclusion of certain native species not found in the larger book, and some taxonomic and nomenclatural changes. The reduction in the size of the book has, however, involved the omission of some matter of interest to the more advanced students of systematics and the authors have, therefore, rightly hoped that those who start with the smaller *Excursion Flora* would progress to the larger work.

The *Excursion Flora* is well suited to the requirements of the University students taking Botany as one of the subjects for the degree course. It has a useful glossary of terms and an index at the end. The printing throughout is good and the general get-up of the book excellent. The authors deserve to be congratulated on bringing out such a work, and it should find a place prominently in all Botany libraries. It is, however, to be doubted whether the price of the book is low enough to tempt students to possess their own copies, at least in this country.

ESBEEKAY.

Bacteriophages. By Mark H. Adams. (Interscience Publishers, Inc., New York), 1959. Pp. xviii + 592, with Glossary, Appendix and illustrations. Cloth bound. Price $ 15.00.

The book is an up-to-date, authentic and complete, yet a concise account on the subject of Bacteriophages. The first detailed book on the subject was written by d'Herelle as far back as 1926, after the discovery of bacteriophage. Since then extensive research on the subject has been going on the world over. The information has been so voluminous and varied that a need for such a book as this was keenly felt by research workers, students and clinicians alike. Mark Adams has done well in writing this book which contains even the critical evaluation of the latest research findings. Today, bacteriophage is not only used for typing the bacterium but also as a model virus in virus research.

The book is divided into 22 chapters excluding the glossary, methods of study, index and bibliography. Further, at the end of each chapter, there is a useful summary. The inclusion of glossary and methods of study has been most thoughtfully done, so as to be helpful both to the beginner and the research worker. When the book was about to be completed, Adams died at the early age of 44 and the task of completing the remaining portion of the book fell on E. S. Anderson, J. S. Gots, F. Jacob and E. L. Wollman, while the responsibility of editing fell on A. D. Hershey. E. Kellenberger is responsible for the excellent electron micrographs. The book is useful both for beginners and advanced students on the subject and should find a place in the bookshelf of every Bacteriological and Virus Laboratory.

V. N. K.

Methods in Enzymology. Vol. IV. Edited by S. P. Colowick and N. O. Kaplan. (Academic Press, Inc., Publishers, New York; India: Asia Publishing House, Bombay-1), Pp. 979. Price $ 24.

The preparation and assay of enzymes and substrates have been the subjects of the first three volumes of this series on "Methods in Enzymology" edited by S. P. Colowick and N. O. Kaplan; these have since

become excellent handbooks in the laboratory for ready reference on the numerous enzyme systems. This volume, the fourth in the series, deals with certain specialized techniques for characterization of proteins, for metabolic studies and for isotope studies which an enzymologist will have occasion to use during the course of his work. Although these subjects have been exhaustively treated in various monographs and publications individually, the editors have felt the need to have them rewritten in order to be particularly suitable for the enzymologist and have therefore included them in this series so as to make this collection a comprehensive treatise on enzymic methods.

The first section on "Techniques for Characterization of Proteins (Procedures and Interpretations)" contains such topics as electrophoresis, paper electrophoresis, ultracentrifugation, diffusion and viscometry, infra-red spectrophotometry, X-ray diffraction of protein crystals, light scattering measurements, flow birefringence and fluorescence. The authors of these articles have described the theoretical and experimental aspects of these methods in detail along with appropriate interpretations. These have been followed by articles on the determination of amino-acid sequence by dinitrofluorobenzene and pipsyl methods and by the usual methods employed for the study of the essential groups for enzyme activity.

Although the title is very general in nature, the second section on "Techniques for Metabolic Studies" deals with only certain limited topics in metabolic studies. The article on assay of respiratory enzymes by B. Chance elaborates the various cytochrome systems and their measurement by the spectrophotometric technique. The articles on "Artificial Electron Acceptors in the Study of Dehydrogenases", "Study of Hill Reaction" and "Methods for Measurement of Nitrogen Fixation" consist of the important methods used in these studies. Of particular interest are the articles, "Micromethods for the Assay of Enzymes" by O. H. Lowry and "Histochemical Methods for Enzymes" by G. Gomori which are a collection of some very elegant methods for determining enzymes on a microscale.

The third section is devoted to a consideration of techniques for isotope studies. Here an attempt has been made to outline those aspects of the theory and practice of isotopic tracers which are most useful in the enzyme studies. For special details, however, it is necessary to consult several of the textbooks which have recently appeared on the subject. The first two articles deal with measurement of radioisotopes and stable isotopes and also description of the types of equipment used. The important features of isotope studies such as the preparation, isolation and degradation of labelled intermediates which will help trace the pathways in metabolism have been outlined. In many of the articles in this section, the preparation, isolation and degradation of the various intermediates in the metabolism of carbohydrates, tricarboxylic acid cycle, purines, pyrimidines, amino-acids, steroids, fatty acids, phospholipids and coenzymes, involving mostly C^{14} labelling, have been described. Also, separate chapters have been included to deal with labelled compounds of isotopes of sulphur, iodine and oxygen.

The editors have stated in their Preface that "Certain articles are already in need of revision and that certain important new subjects are not covered at all", and they have promised to make up these deficiencies in a supplement. In such a fast-expanding subject as Enzymes, it is very difficult to keep pace with the progress for any kind of a comprehensive treatise without being out of date very quickly. In this respect the editors have done a commendable job in bringing together the basic methods involved in the study of enzymes in one volume such as the present. In the reviewer's opinion such a volume as this will be extremely useful not only as a reference work in the laboratory but also as a text-book for understanding the theoretical principles involved in such a study on enzymes.

P. S. SARMA.

Books Received

Polymer Reviews, Vol. 2. (*Linear and Stereoregular Addition Polymers: Polymerization with Controlled Propagation.*) By N. G. Gaylord and H. F. Mark. (Interscience Publishers Inc., New York 1, N.Y.), 1959. Pp. x + 571. Price $ 17.50.

The Wealth of India—Raw Materials, Vol. V—H-K. (Council of Scientific and Industrial Research, New Delhi), 1959. Pp. 332. Price Rs. 30·00.

The Influence of Hormones on Lipid Metabolism in Relation to Arteriosclerosis. By Abraham Dury, C. R. Treadwell and others. (*Annals of the New York Academy of Sciences*, Vol. 72, Art. 14), 1959. Pp. 787-1054. Price $ 4.00.

Hematopoietic Mechanisms. By W. S. Root and A. H. L. Alt and others. (*Annals of the New York Academy of Sciences*, Vol. 77, Art. 3), 1959. Pp. 407-820. Price $ 5.00.

The Biology of the Amœba. By H. I. Hirshfield, E. Borysko and others. (*Annals of the New York Academy of Sciences*, Vol. 78, Art. 2), 1959. Pp. 401-704. Price $ 4.50.

Organic Chemistry an Outline. By C. Hansch, G. Helmkamp. (McGraw Hill Book Co. Inc., New York-36, N.Y.), 1959. Pp. vi + 258.

The Structure of the Physical Universe. (Preliminary Edition.) By D. B. Larson. (D. B. Larson, 755, N.E. Royal Court, Port Land 12, Oregon), 1959. Pp. v + 218. Price $ 6.00.

Text-Book of Physics. (Revised Edition.) By R. Kronig. (Pergamon Press Ltd., London W. 1), 1959. Pp. xiv + 961. Price 84 *sh.*

Radiopaque Diagnostic Agents. By M. H. Poppel. (*Annals of the New York Academy of Sciences*, Vol. 78, Art. 3). Pp. 705-1020.

The International Astrophysics Series, Vol. V. *Close Binary Systems.* By Zdenek Kopal. (Chapman & Hall Ltd., London W.C. 2; India: Asia Publishing House, Bombay-1), 1959. Pp. xiv + 558. Price 105 *sh.*

Reading German for Scientist. By H. Eichner and H. Hein. (Chapman & Hall, London W.C. 2; India: Asia Publishing House, Bombay-1), 1959. Pp. xi + 207. Price 30 *sh.*

The Living Body a Text in Human Physiology. 4th Edition. By C. H. Best and N. B. Taylor. (Chapman & Hall, London W.C. 2; India: Asia Publishing House, Bombay-1), 1958. Pp. xi + 756. Price 45 *sh.*

Grasslands. Edited by H. B. Sprague. (American Association for the Advancement of Science, Washington D.C.), 1959. Pp. xv + 406. Price $ 9.00.

SCIENCE NOTES AND NEWS

Inheritance Study in Gram

Shri J. A. Patil, Department of Agriculture, (Bombay), Poona, reports that in crosses between the spreading type mutant in gram reported by Chavan and Argikar (*Indian Farming*, 1950, 40, 539) and the erect types Niphad 10, Niphad 30 and Niphad 31, a monogenic inheritance was found. The erect type was found to be the dominant character.

Award of Research Degrees

Andhra University has awarded the D.Sc. Degree in Pharmacy to Shri E. Venkata Rao for his thesis entitled "Chemical Investigations of Some Cardiac Drugs and Other Poisonous Plants of India" and D.Sc. Degree in Geology to Shri M. Subba Rao for his thesis entitled "Some Aspects of Continental Shelf Sediments Off East Coast of India".

The Osmania University has awarded the Ph.D. Degree in Chemistry to Shri T. Navaneeth Rao for his thesis entitled "A Kinetic Study of the Chain Photolysis of Hydrogen Peroxide in Aqueous Solution", Ph.D. Degree in Zoology to Shri Ram Mohan Todd for his thesis entitled "Studies on Parasitic Protozoa of Wild Mammals" and Ph.D. in Mathematics to Shri. V. Lakshmikantam for his thesis entitled "Studies in the Theory of Non-linear Differential Equations".

Essen & Co., Analytical Chemists and Assayers, Bangalore

Dr. K. R. Krishnaswamy, D.Sc. (Lond.), F.R.I.C., Retired Professor, Indian Institute of Science, has joined the Company as its Technical Director.

Instruments Symposium and Exhibition—1959

The Defence Research and Development Organisation of the Government of India held a Symposium on Instruments along with an Exhibition of Instruments designed, developed or produced in India, at the Technical Development Establishment (Instruments), Dehra Dun, on the 4th, 5th and 6th November 1959. The main objects of the Symposium were (*a*) to create a national awareness of the problems connected with the subject of instruments and instrumentation; (*b*) to review the existing state of instrument industry in the country and to suggest ways and means for its future development with a view to self-sufficiency; (*c*) to step up the research, design and development activities in this field; and (*d*) to provide a useful forum for mutual exchange of ideas and information on the various problems connected with the subject.

The Symposium was attended by over 260 delegates from more than 80 different organisations and institutions in the country. Dr. D. S. Kothari, Chairman of the Conference, gave the

pening speech. Shri O. Pulla Reddi, Defence Secretary, delivered the inaugural address to the Symposium and later opened the Instruments Exhibition.

First All-India Congress of Zoology—1959

The First All-India Congress of Zoology, sponsored and organised by the Zoological Society of India was held from October 24-28, 1959, at Jabalpur at the invitation of the Jabalpur University.

The Minister for Scientific Research and Cultural Affairs, Professor Humayun Kabir, inaugurated the Congress. Dr. M. L. Roonwal, Director, Zoological Survey of India, in his Presidential Address, emphasised the need for work on field ecology and taxonomy and the importance of the protection of wild life.

Abstracts of nearly 120 papers received for presentation at the sectional meetings were printed and issued in advance.

Disposal of Radioactive Waste

All available information indicates that in the not distant future the production of electric power from nuclear energy will be more economical than its production from the conventional fossil-fuel resources. How soon this will happen is dependent on how fast nuclear technology will advance. One problem of pressing importance in the development of nuclear plants is that concerning the Disposal of Radioactive Waste. Whatever methods of disposal are chosen they must have the overriding aim of not endangering man either immediately or in the long run. Atomic age must be a safe age, and Science must realise its moral obligations in regard to the problem of waste disposal.

These points were brought to focus at the International Conference on Radioactive Waste Disposal which concluded its one week session on 21 November 1959, in Monaco. The conference was attended by 308 experts from 32 countries and 11 international organizations. In the papers presented at the Conference and in the discussions that followed, the problem of waste disposal was discussed from all the major practical and theoretical points of view. It was pointed out that in the United States alone the nuclear power industry would have produced, by the year 2000, wastes amounting to 3 million curies of activity.

The three obvious sinks for the disposal of radioactive waste are the atmosphere, the ocean and the earth. An expert from Norway, speaking of the potential suitability of the earth's atmosphere for disposal operations, said radioactive particles remained in the stratosphere for a period long enough to allow certain substances to become harmless before they returned to the earth's surface. A British Scientist described disposal methods at Harwell, where extreme care had to be taken because low level liquid waste was discharged, after special treatment into the Thames, which was the main source of London's drinking water. No solid waste was buried at Harwell in order to avoid any danger of seepage into the river.

A subject which provoked considerable discussion concerned waste disposal in the sea. A Soviet scientist said that research specially conducted for the purpose has shown that there are no stagnant zones in the ocean, but that the water circulates everywhere down to the ocean floor. Radioactive wastes dumped into the ocean at great depths are sure to rise to the surface. Strontium-90 and other radioactive substances will be assimilated by plankton, then by flesh-eating fish and will become a hazard to human life. Another opinion was that disposal in the ground was the safest method available today ; the material should be enclosed in solid blocks of concrete or glass and stored at appropriate depths and under permanent human control. The problem of radioactive waste is really one of storage rather than of disposal.—*IAEA News.*

Potassium Reduces Strontium-90 Uptake in Plants

According to Dr. W. F. Libby the use of certain fertilizers may reduce the danger of radioactive contamination of the earth's soil. His research showed that the use of potassium —an ingredient of many fertilizers—reduced the amount of strontium-90 that is found in plants. Scientists are especially concerned about this atomic fall-out contaminant, since its too large a concentration in food products could conceivably lead to bone cancer.

Dr. Libby grew radishes from seeds planted in soil contaminated with known amounts of strontium-90. Other non-radioactive chemicals were also added to the soil to see if they would increase or decrease the amount of strontium-90 that ended up in the plants. Potassium was most effective in reducing the amount of strontium-90 taken into the plant. When added to the soil in small concentrations, it reduced radioactivity in the mature radish plants by as much as 40%.—*ISLO News.*

Cobalt-Platinum Magnetic Alloy

The outstanding magnetic properties of certain alloys in the cobalt-plantinum series have been known to metallurgists for many years, but it is only recently that the properties of the alloy containing equal numbers of the atoms of each element (23·3% by weight of cobalt) have been fully appreciated. After heat treatment by a special process, it is claimed that the alloy has remarkable physical and magnetic properties: a remanence of 6400 G; a coercive force of 4,800 oersted; a BH (max.) of $9{\cdot}2 \times 10^6$ G oersted. Moreover in the heat-treated state the alloy is magnetically isotropic. It is comparatively workable before heat treatment and can be machined, rolled and drawn without difficulty. It thus lends itself to the manufacture of magnets of complicated shape or extremely small size.—*J. Sci. Inst.*, 1959, **36**, 416.

New Devices for Prospecting Minerals and Oils

A pulse neutron generator devised by Russian scientists is claimed to represent an effective technique for probing oil wells and obtaining cross-sections of oil-bearing strata and determining the water-oil boundary. The generator can operate in oil wells down to a depth of 3,000 metres at extremely high pressures and temperatures. It represents a long thin "shell" housing an ionic accelerator of a linear type, a system for maintaining high vacuum and a voltage source up to 100 kv. When lowered into the well the generator produces a neutron field the intensity of which gives an indication of the kind of liquid impregnating the rocks.

A new method of prospecting minerals is based on the use of pulsations of the earth's electromagnetic field, which are caused, in particular, by the sun's corpuscular radiations. It differs from the old methods in that the vertical, and not the horizontal, electromagnetic pulsations are used. A photoelectro-optical amplifier is used to measure the pulsations. The new method tested under field conditions is reported to have yielded positive results.—*Soviet News.*

Plasma Generator

To test new materials for use as nose cones in ballistic missiles, environmental conditions of temperatures and pressures associated with the hypersonic re-entry of the missiles have to be simulated in the laboratory. The plasma generator produced by the Avco Research Laboratory (U.S.A.) is capable of supplying this need. The generator heats gases to high temperatures by passing them through an electric arc. The gas to be heated is injected tangentially into the arc chamber, flows through the area occupied by the arc discharge, momentarily becomes part of the discharge, and then flows through the throat of the anode into a plenum chamber. In the plenum chamber different portions of the gas mix to produce a greater uniformity of plasma temperature and velocity at the exit nozzle. The working plasma is then discharged into free or controlled atmospheres. Although the unit is normally operated with air it may also operate as required with other gases including helium, argon and nitrogen.

The arc uses from 20 kilowatts to more than one megawatt of power. Temperatures obtained with the plasma generator have reached 18,000° F. The device also has been used for arc-heated wind tunnel experiments.—*J. Frank-Inst.*, 1959, **268**, 335).

Survey of Earth's Magnetic Field

The scientific expedition, aboard the Zarya, the non-magnetic oil-and-motor schooner, organized by the Institute of Magnetism of the USSR Academy of Sciences, under the IGY programme, has yielded fresh data and conclusions on the earth's magnetic field. Preliminary results show that the declination given by the existing nautical charts differs somewhat from the declination observed. The largest difference, about 3°, was observed in the Gulf of Guinea. Several magnetic anomalies were observed in the Atlantic, particularly in the Atlantic ridge zone. A number of magnetic anomalies were found also in the Indian ocean. This year the schooner has been equipped with two new instrumentations, an ionospheric station and a neutron monitor. The ionospheric station will make it possible to study in greater detail the distribution of electronic concentration in the equatorial zone. The neutron monitor designed to register the nucleonic component of cosmic rays will help to define the latitudinal effect, particularly in the region of the magnetic equator.—*USSR Information Department.*

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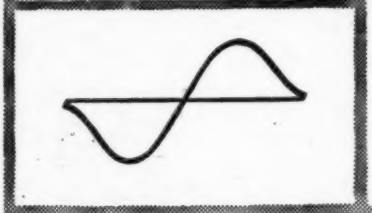

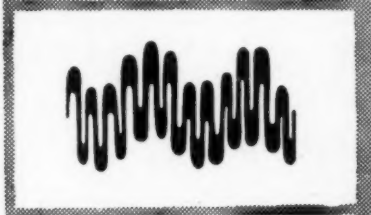

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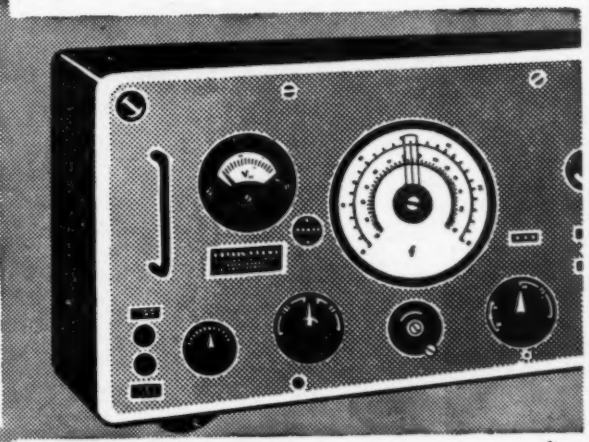

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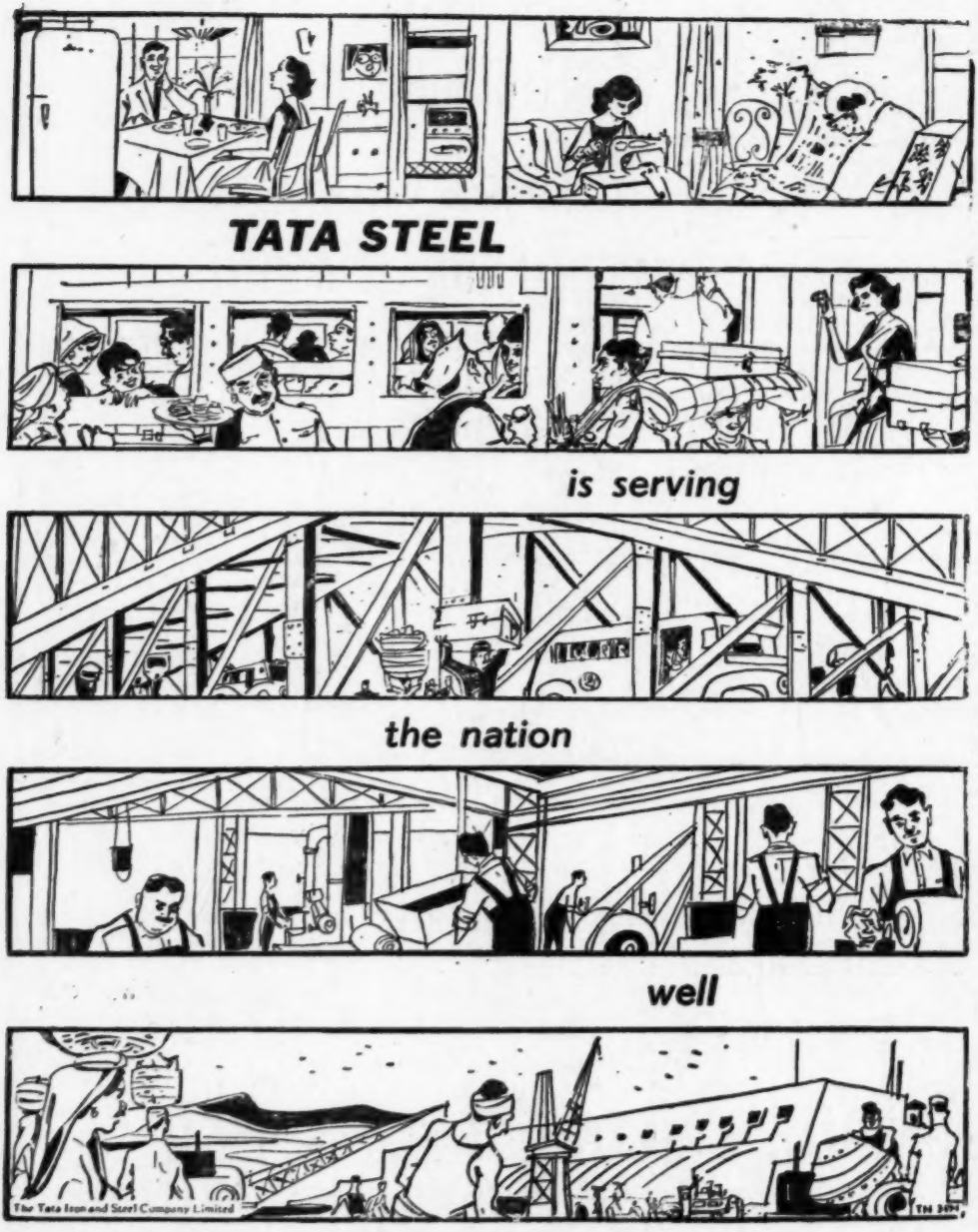
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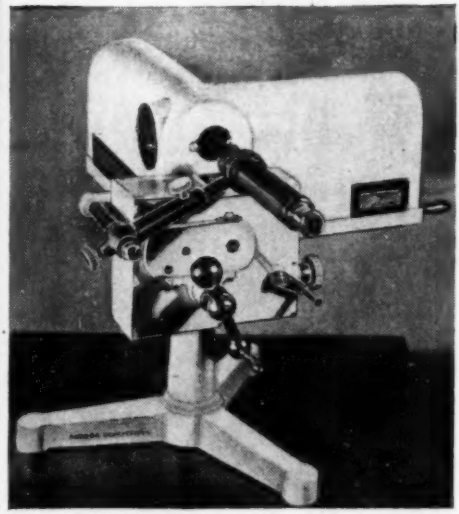

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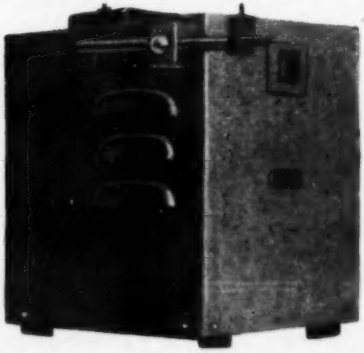

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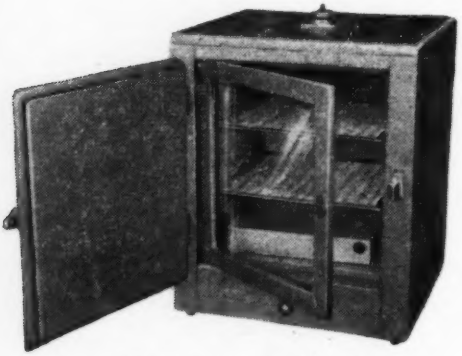

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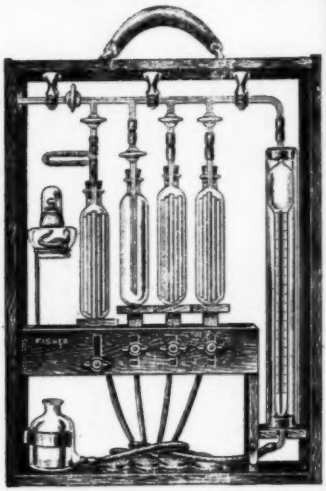

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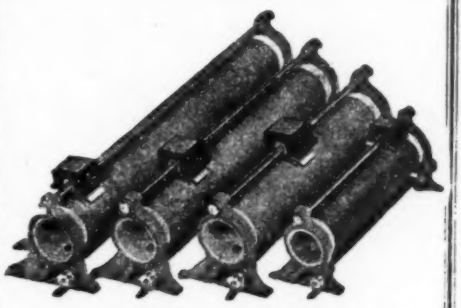

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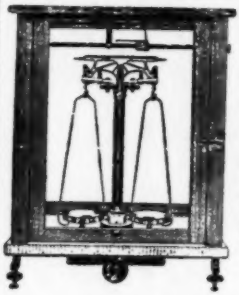

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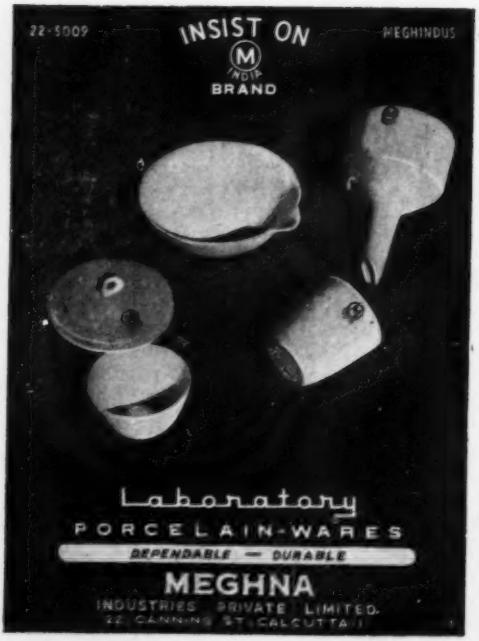

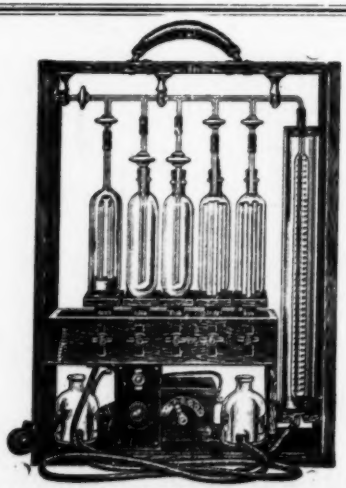

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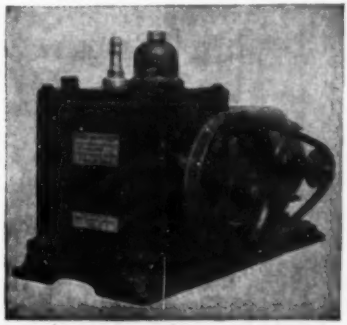

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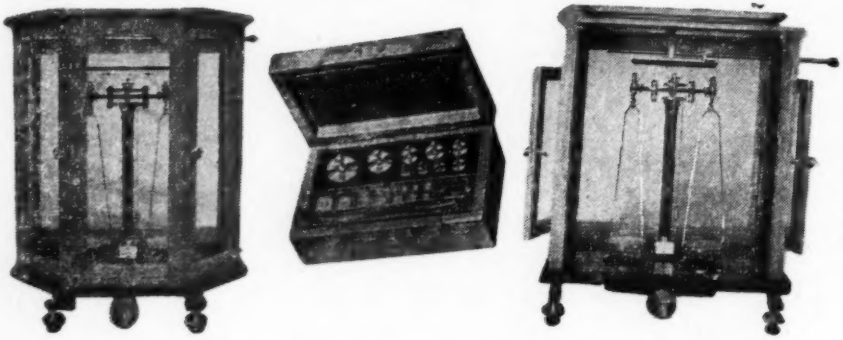

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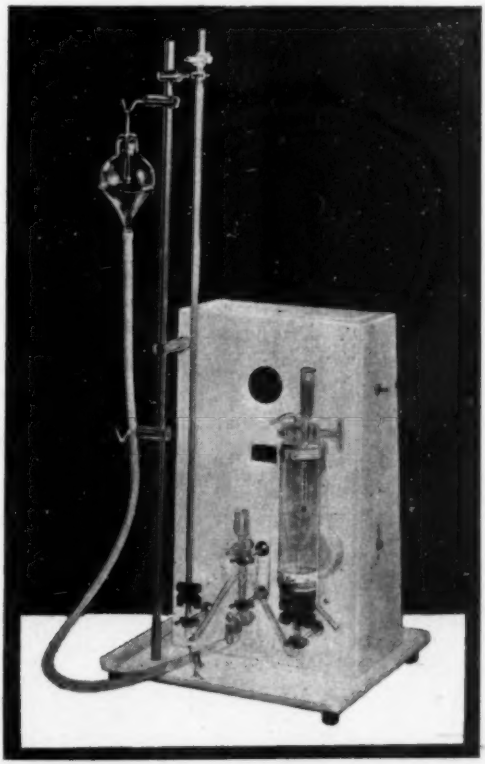

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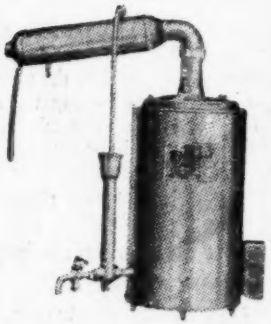

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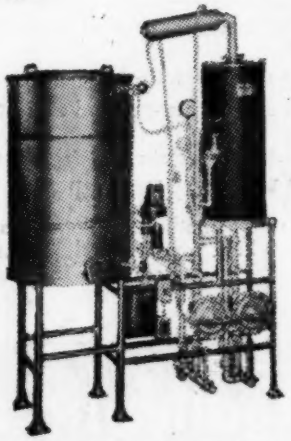

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